Concrete

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We Learn About Good Houses by Seeing Bad Ones

By Harvey Whipple
EDITOR CONCRETE

IT makes one think of the stone that was rejected by the builders and became the corner stone of the temple. No building material was ever so much despised as the concrete block. It *was* often a poor thing—and still is sometimes. Self respecting architects had no use for it who now find nothing else to serve its purpose so well.

There is nothing more evident in the building field than the ascendancy of the concrete masonry unit—whether it be brick or block or light weight tile.

The pages of this magazine, which once a year celebrates the progress of better houses, are sprinkled with pictorial evidence of what the concrete unit is doing to house construction, more especially in America, "a nation of high standards," which is beginning to apply them to its homes. And in all these houses the unit itself is scarcely seen in the finished job. It is covered with stucco, at so much per yard in a bewildering variety of textured effects.

It is the concrete masonry unit that has delivered the public from the necessity of wooden dwellings. The concrete products industry has done the thing by learning how to make sound masonry units by the million, up to a standard, and at a price which makes the wooden house an expensive luxury.

A friendly Providence presides over our affairs. Having cut and burned up our trees until most of what is left of them is so far away that the price of lumber goes soaring, we are able to turn to the rocks of the everlasting hills and make them up into habitable dwellings.

* * *

THE concrete masonry unit is a thoroughly established thing before its manufacturers have mastered half the technique of its economical production. But that better technique is within reach. It is proved. It is now merely the slow process of passing it on from one factory to another. Of the seven thousand or more block makers, there are but comparatively few to whom "fineness modulus" is more than the bewildering catch phrase of the laboratory crank.

But when one manufacturer pursues the thought to its lair and makes it his own in his own plant and puts "fineness modulus" to work for him it makes a difference. In more than one plant it has cut the cement cost of an 8 x 8 x 16 unit from four cents to three and increased the strength of the unit by the same operations. What will other concrete block makers do about that? They will get acquainted with "fineness modulus" and other "absurd laboratory folderol"—because a cent a block is good wages.

* * *

ALL of which is by way of saying that when the concrete masonry unit manufacturers really find themselves they will make their product even more irresistible. Then the concrete masonry house will be a more general deliverance from windblown wastage of types of frame construction (and the scarcely better veneer of the Middle West) with which, by pitiful skimping and slender makeshifts, builders are trying to stem the tide of high house cost by the dangerous course of elimination.

* * *

IT was so hard for the public to absorb the thought that a $5,000 house in 1914 cost $10,000 in 1924 that the drift has been to all manner of doubtful economies. Much fault lies in the progress of mere prettiness—in itself a real blessing. A good *looking* plan can be had for five dollars.

And there are plenty of builders who can put up these houses so they are hardly sturdy enough to hold up their architecture.

And how the merry little heat units, which father shovels in at 'steen dollars per ton, go skittering out of that pretty architecture to the wide and breezy out-of-doors!

Many an almost home owner (at one percent a month) is even now thinking harsh thoughts. He will not keep his thoughts to himself, either—and so, long before he has paid the last of the monthly one percents, his neighbors will have learned something about houses. They will know that the extra fifty dollars a year for fuel and the extra fifty dollars for paint and the extra fifty dollars for repairs might better, even at six percent, be built into the walls.

Then what kind of walls will they be?

If the concrete block manufacturer has learned how to apply the "fineness modulus" to his business he will know what kind of walls.

* * *

NOR is that all of the picture.

We are making progress, but walls aren't all. What of the floors?

It is not the house *buying* public alone that resists each thrust of a new idea. The *building* public, in spite of air plane and radio, is still ruled by the ways of its fathers.

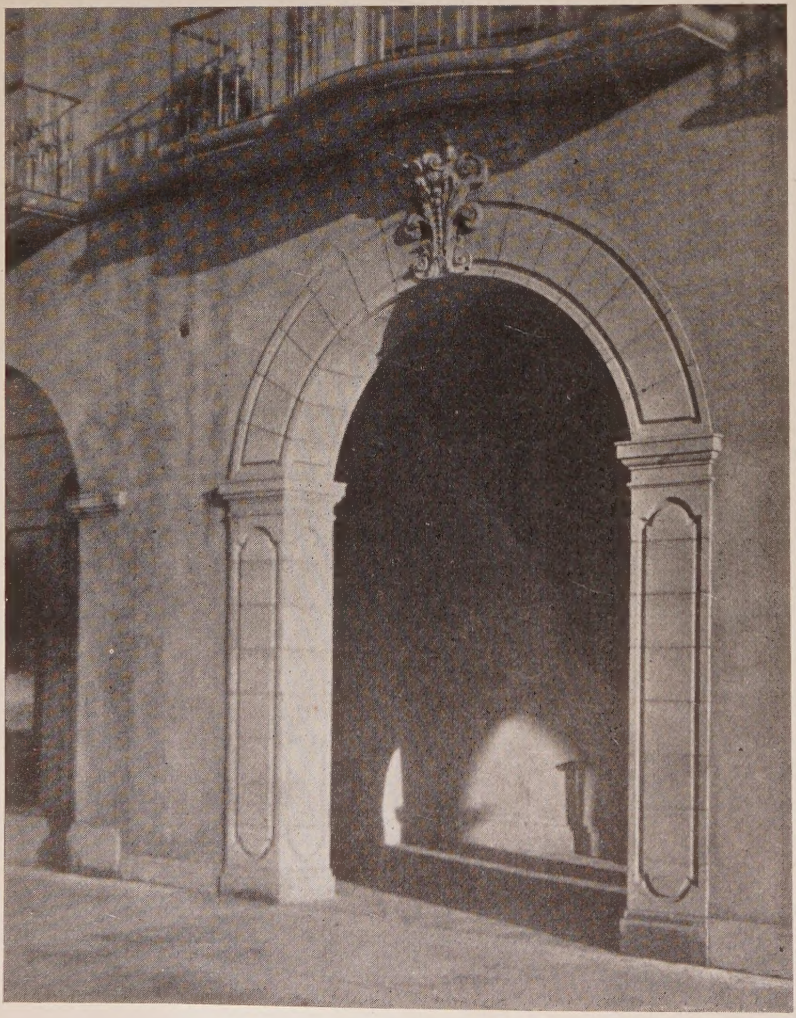
House floors have been of wood. House floors shall be of wood.

Not for long. We creep before walking. First we learn how to *protect* wood with metal lath as a base for plaster and stucco. Then we learn how to eliminate wood from all vulnerable parts so we may conserve our supply of it for those uses which nothing satisfies as do the beauties of wood. In this magazine are some fireproof floor details which may encourage the doubtful builder—persuade him to add something to his bag of tricks.

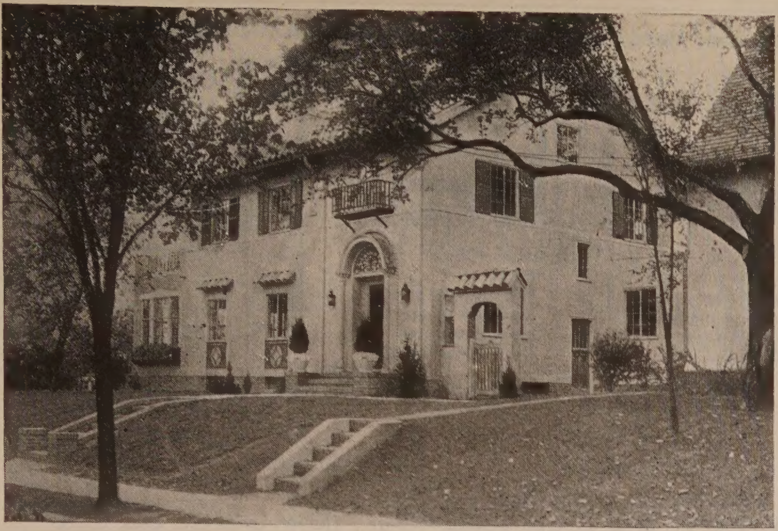
We live in the future. We are learning to demand better homes. This year better homes means one thing—next year's better home will be better.

The public does not rise in mass and demand a definite better thing. The public demands things when it finds a few people have and enjoy them.

The public does not demand fireproof homes. But it will buy them, enjoy them, talk about them —and then—that is the builder's opportunity.



Detail of Carrillo Building, Santa Barbara, California; Marston and Van Pelt, architects, Pasadena; built of concrete by C. W. Northrup, Santa Barbara, with Van Guilder double wall machine. The first story wall consists of two six-inch sections; second story six inches and five inches, each with continuous air space. The building received first award from Plans and Planting Committee of Community Arts Association, as example of Spanish Colonial architecture produced in Santa Barbara in 1922—this architecture being encouraged as appropriate to the Mission City]



It is no longer enough that a house look well—how is it "just under the skin?"

Fig. 1—A Hueber-built fireproof house

Progress in Permanent House Construction

Building the Floors Right as Well as the Walls

Paul Hueber, the architect of the Hueber Brothers, Builders, organization, Syracuse, N. Y., says that people don't know what they are talking about, who say there is no demand for fireproof houses.

He points out that old Dobbin was good enough, and automobiles not in demand, until manufacturers made automobiles—a little better and a little cheaper every year. The people of Syracuse are being educated to better houses by seeing them built, by living in them, by visiting in them and by just such incidents as the fire related here by Mr. Hueber. If the fruit cellar had been enclosed by metal lath and plaster there wouldn't have been any soot and smoke to spoil the decorations. People will buy better things when they are sold on the idea that the better things really exist and are worth the money.

We wrote to Mr. Hueber to inquire about progress in the public's acceptance of fireproof houses so we could tell you about that progress in this issue of Concrete. Hueber Brothers' work is well known to our readers because it has been described in occasional articles in this magazine for several years back. They build just a few houses a year with a small, well knit family organization in which you might on a few jobs have seen technically trained college men as "hunkies." With that kind of organization they have been able to study every construction detail in actual practice and every season, every job, has developed a few improvements.

America has emerged from a forest where the log house was logical, into a cleared-up country with large congested centers. The log house was prodigal of material. The balloon frame is scanty, flimsy, wasteful and a fire menace. But the use of wood is a habit. Concrete masonry units are breaking us of that habit. The house whose entire structure is concrete (or in certain parts some other unburnable and stable material) is the next step. Hueber Brothers and a few other pioneer builders here and there throughout the country, have taken that step. It is not merely a matter of fireproofness, though that were enough; it is a matter of stability, permanence, absence of costly upkeep and the satisfaction in livableness which is greater than the money savings.

Mr. Hueber answered our inquiry with a letter which he did not intend for more than a basis of such comment as might be written, but the letter seems to fit in with the drawings which he has supplied and has that directness in

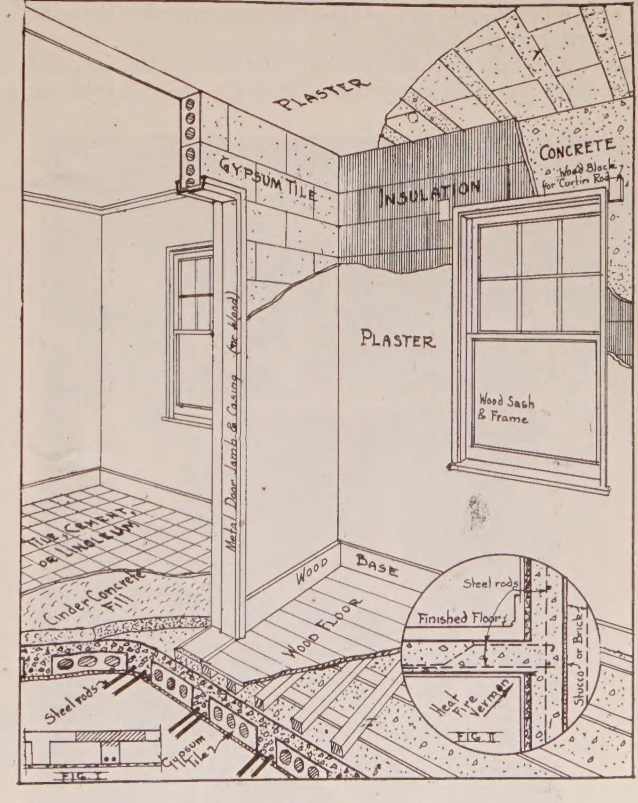


Fig. 2—The structure of a Hueber house

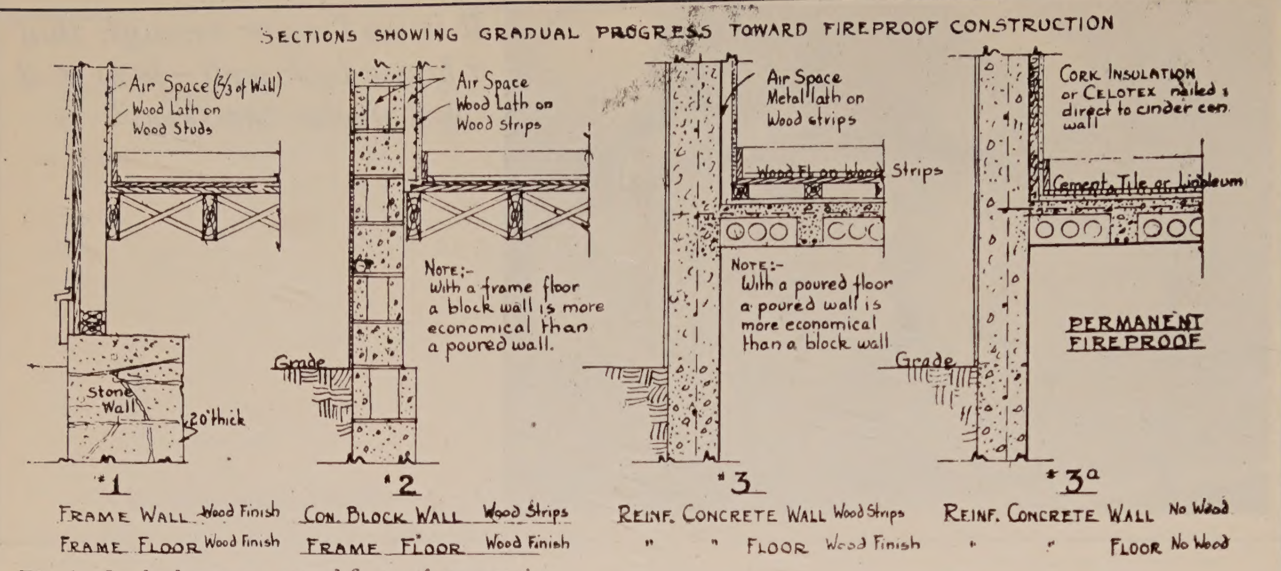


Fig. 3—Gradual progress toward fireproof construction

the report of his organization's experience that it is given here essentially as written.

* * *

A Letter from Paul Hueber

ARCHITECT, HUEBER BROTHERS, SYRACUSE, N. Y.

Your letter arrived a day or two ahead of a fire in one of our houses in which the fireproof floor played a prominent part. While this fire was unfortunate for the owner it certainly helped to advertise fireproof homes and all the owners of our concrete homes feel more satisfied than ever.

The fire occurred in the fruit compartment (built of wood studs and sheathing) in the cellar. It was discovered by the maid at 7:00 o'clock in the morning and it must have been burning for some time. It was amusing to hear the owner tell how, from his bedroom window, he told the firemen:

"It is a concrete house—it will not burn—the fire is in the basement, just put it out."

They told him that they would take care of the fire, and from habit proceded to cut a hole through the wall over the window of the fruit cellar, but as the picture shows, the laugh was on the firemen for they broke their axe.

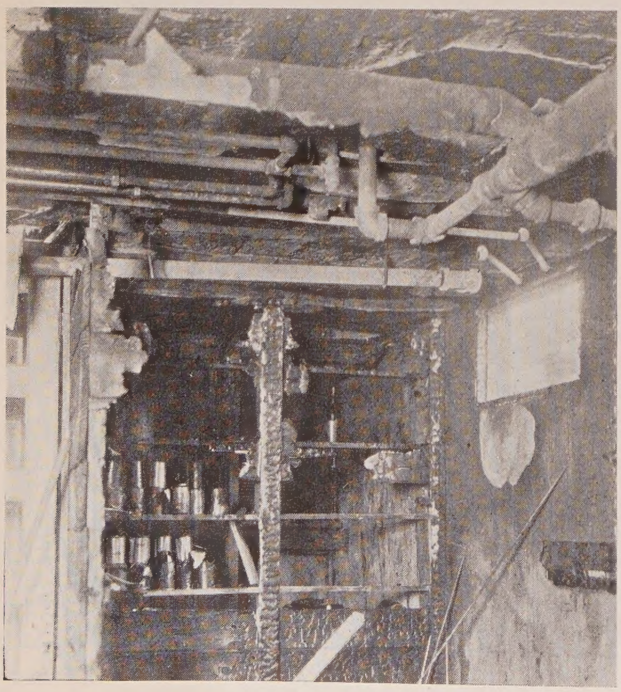


Fig. 4—The fruit cellar after the fire

The loss from the fire itself was very slight, but unfortunately the maid opened the cellar door and other doors about the house and the steamy, soot laden smoke caused considerable damage to wall decorations, draperies and furniture.

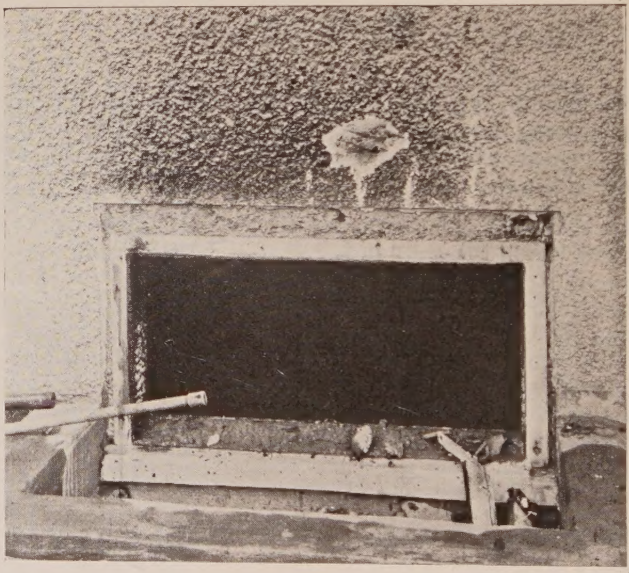
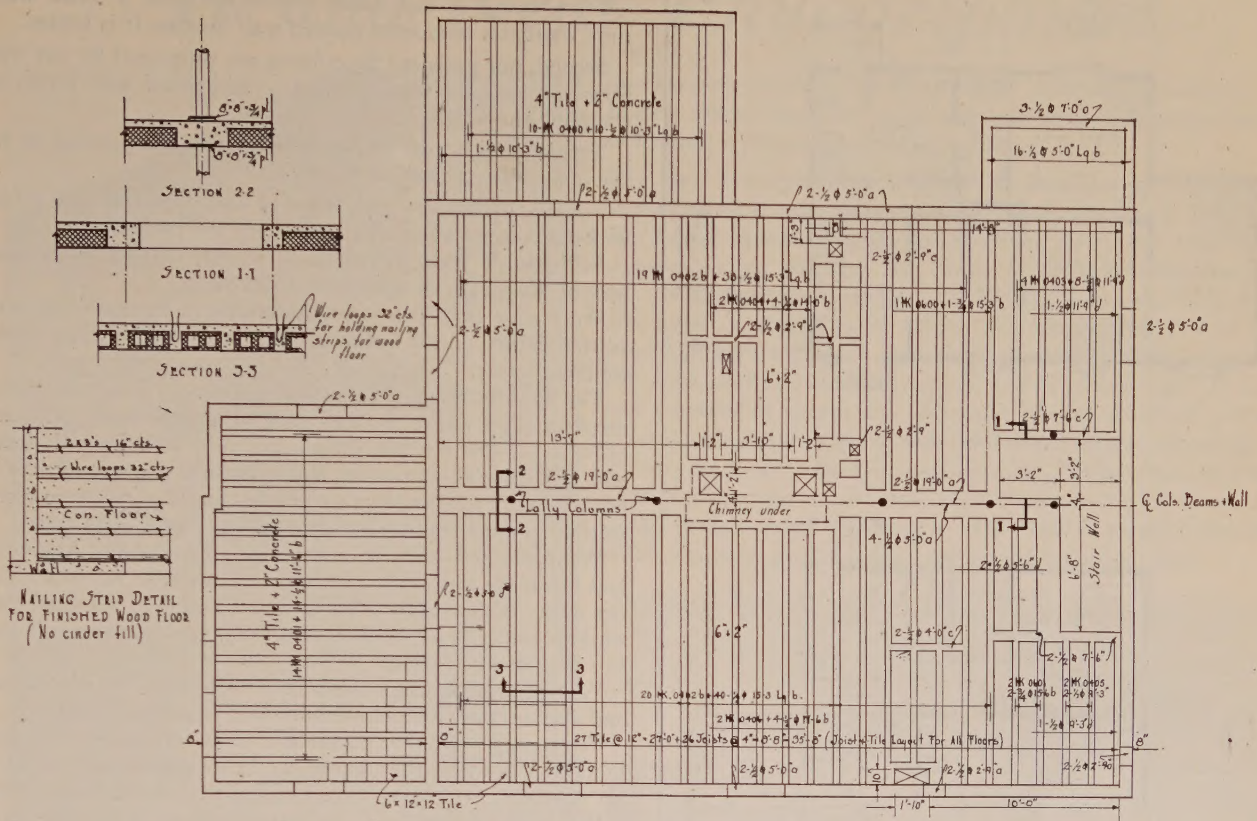


Fig. 5—Fruit cellar window from the outside showing dent in concrete wall where firemen thought they would "catch the fire before it went up between studs" as it promptly does with the usual frame construction. The firemen broke their axe on the first blow

We had plastered the wall and ceiling and what appears to be spalled concrete in the pictures is simply fallen plaster. The linoleum on the kitchen floor directly over the fire was so hot that it blistered the maid's feet as she walked over the floor during the fire.

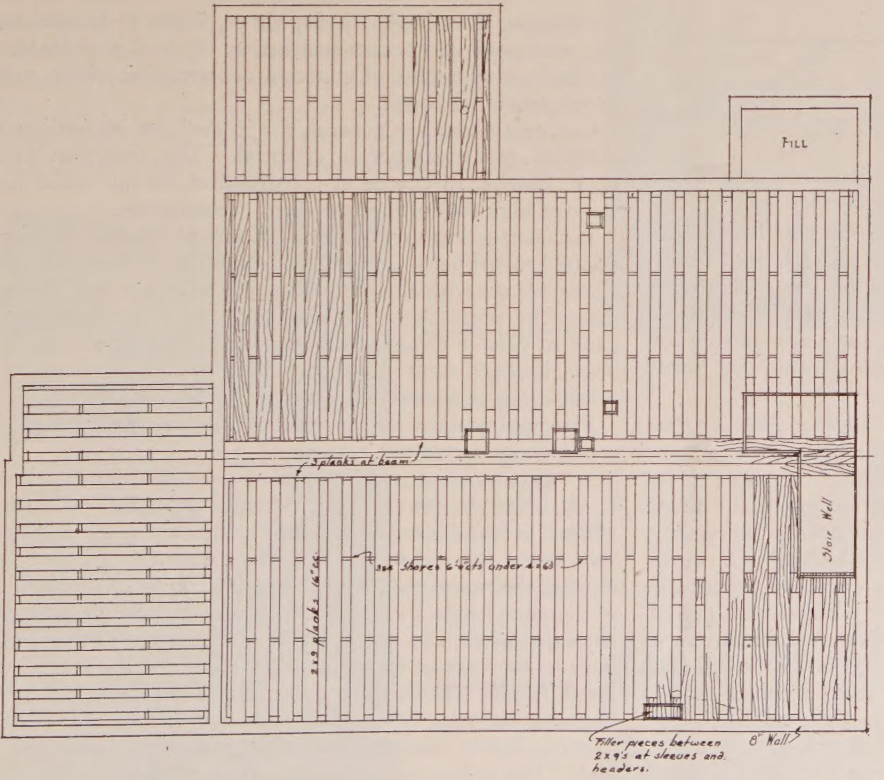
The fireproof floor of reinforced concrete, built as we build it, is not as expensive as the average builder believes—but it is so different from wood joist construction that the average home builder is afraid of it. It would be useless to give comparative costs. With concrete floors we have to run the electric wires in conduit, which costs more than knob and tube work; we build our partitions of tile which costs more than wood studs and lath; the sleepers for nailing the wood floor



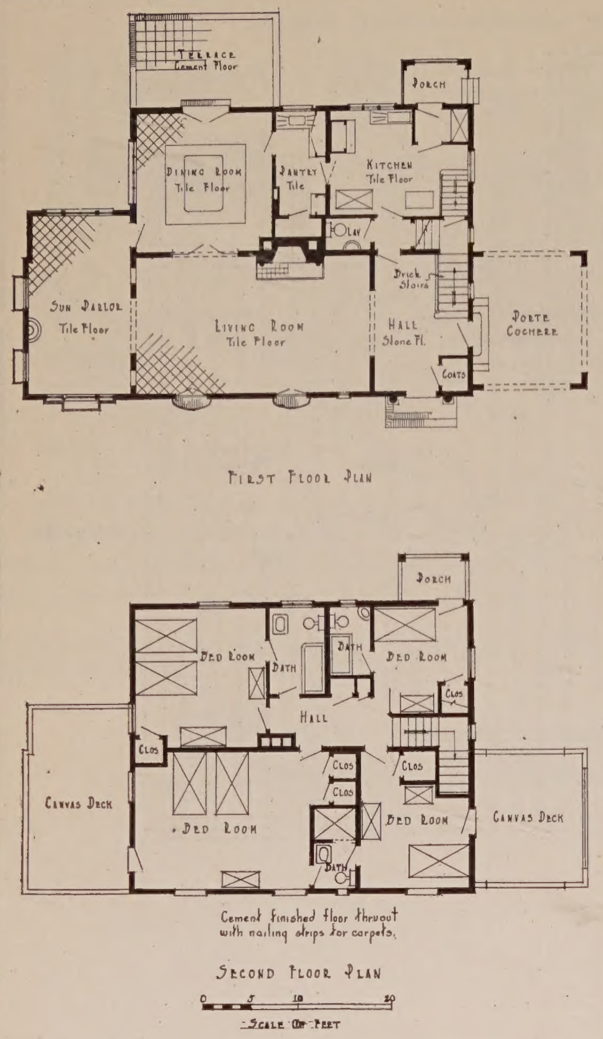
Section 2-2
Section 1-1
Section 3-3
Wire loops 32" cts. for holding nailing strips for wood floor
2x3's 16" cts.
Wire loops 32" cts.
Con. Floor
Wall
Nailing Strip Detail For Finished Wood Floor (No cinder fill)
4" Tile + 2" Concrete
Lolly Columns
Chimney under
Stair Well
℄ Cols. Beams + Wall
6"+2"
6"x12"x12" Tile
27 Tile @ 12" = 27'-0" + 26 Joists @ 4" = 8'-8" = 35'-8" (Joist + Tile Layout For All Floors)
1'-10"
10'-0"
8"

Fig. 6—Reinforcing and form details (the latter for limited use with block walls—which Hueber does not use having standard wall and floor form units)

The details on this page were worked out for plan shown in figures 7 and 8



Fill
3 planks at beam
Stair Well
3x4 Shores 6' cts. under 4x6's
2x9 planks 16" cc.
Filler pieces between 2x9's at sleeves and headers.
8" Wall



Figs. 7 and 8—A typical Hueber-built house plan. See form details, Fig. 6

are another extra cost, so you see it is not the concrete alone that costs extra. Again, elevating the concrete for houses is a special problem.

Drawings show reinforcing and form details for one of our houses—form details being for stock lumber.

We have reached the point where the concrete house sells itself. In our new development, two of three houses under way are of concrete on the choice of the owners. One hears about 'no demand' for concrete houses, but there is a demand when people know about them. The people are waiting for builders to build them. There was no demand for autos before manufacturers made them!

On looking over a recent issue of the *Saturday Evening Post* I was struck by the improvements in the new cars and then recalled that a few years ago we thought that cars were about as nice as we could expect. So many people, especially those with experience in concrete, furnish a good parallel when they say that a block wall is cheaper than a poured wall. Of course it is, if we compare the usual methods employed where the forms are custom made for a particular job and used only a few times. What if block machines were made in the same manner, and what if hand labor were used for block building operations. Wipe out the engineering study of block manufacturing and where would the block business be? The problem of poured houses is a more difficult problem, but that is no reason for thinking that no progress will ever be made over the first attempts. Time and concentration will do the trick.

We are often asked why we pour our walls instead of using block.

First, many of our clients would not take a block wall; they wanted a reinforced poured wall because it is better.

Second, our patented floor forms are supported by our wall forms so that we require but few additional wall forms to complete the wall.

Third, it takes just so much equipment for pouring so we use it for walls as well as floors.

Fourth, carpenters and laborers can complete the frame without masons when walls and floors are poured.

Fifth, with properly designed forms, poured walls with poured floors, are cheaper than block walls.

We realize that there is considerable to be done yet with poured houses, but it has most to do with the finishing of the concrete frame.

The floor forms shown on drawing are very good for limited use with block walls. Poured walls with these floors forms are expensive. Sleeves are very important with poured floors and we locate all sleeves on our structural plans so that it is not necessary for the plumber and heating contractor to come to the job until it is ready for installing pipes.

We place our lally columns after floors have hardened and forms are stripped. In this way our floor forms are not cut into. Also it takes a lot of bracing to hold columns true while pouring floors, and placing them afterwards eliminates this temporary bracing.

We do not let winter weather stop operations, but use canvas and salamanders just as we do on our larger buildings.

We have proved that people want fireproof homes and well built homes when they know they can get them. And it isn't necessary that they have a millionaire's bank book either.

We have proved that good architecture is possible with standard forms, which are necessary for economic reasons.

They cost more than wood houses, but the difference will be cut as more builders study the problem and study it as the block has been studied, or the automobile.

Floors at Mooseheart

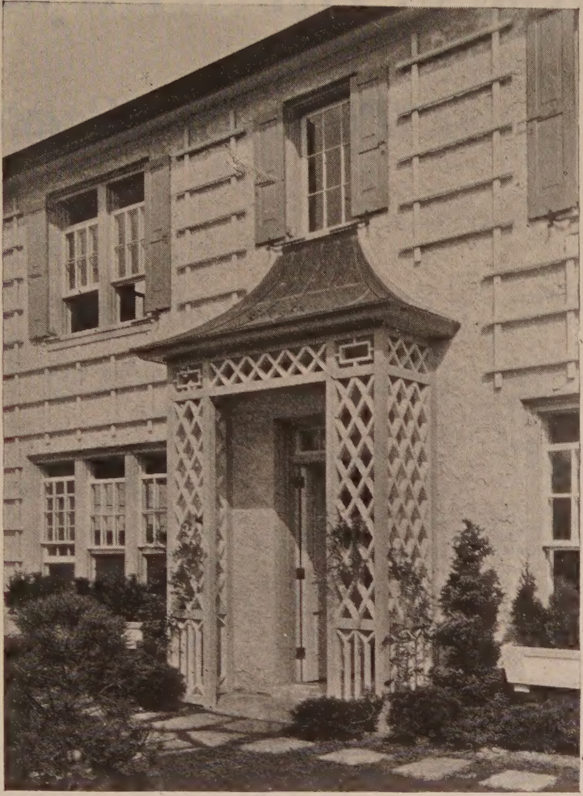
Cottages, dormitories, halls, shops, barns at Mooseheart, Ill., the home and school institution of the Loyal Order of Moose, are examples of concrete construction which many people travel far to see.

Concrete floors are general, for in such an institution for children, fire resistance is essential. The workmen under R. F. Havlik, in charge of construction, do not make hard work or high cost of fireproof floor construction.

In constructing these floors, Mr. Havlik makes use of corrugated metal pans, inverted, as the main part of the forms. These are set with their edges upon planks laid flat and supported by posts below. Sufficient space is left between the pans to permit forming the beams of requisite width. The beam reinforcement is laid in these spaces, and so far as possible, pipes and conduits are made to follow them.

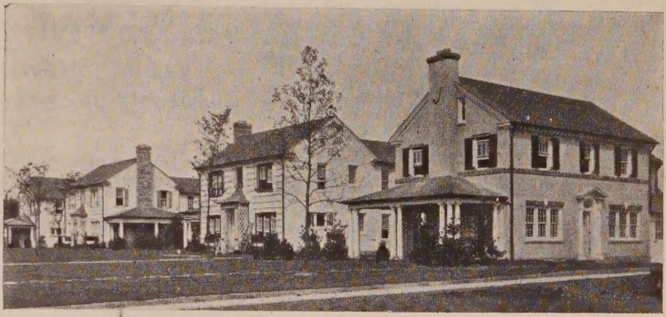
Principal support for these floors is usually on the masonry wall, where an ample bearing of 4 in. is provided. Fine netting or building paper is placed over the openings in the block below to prevent the concrete from falling through while it is being placed. A board braced along the top of the wall forms the end of the floor slab, with enough space left outside the end of the slab for laying a course of veneer block of the same height as the other courses. If the floor is thinner than the height of a single course of block, the former can be built up to the same thickness as the block and the next regular block course laid directly upon it. A narrow space is left between the edge of the floor slab and the veneer block to prevent direct conduction of cold from the exterior to the slab. The spaces between the pans are filled in with concrete, the thickness of concrete over them being made about 2 in. (Also see Floor Details, pages 50 and 51).

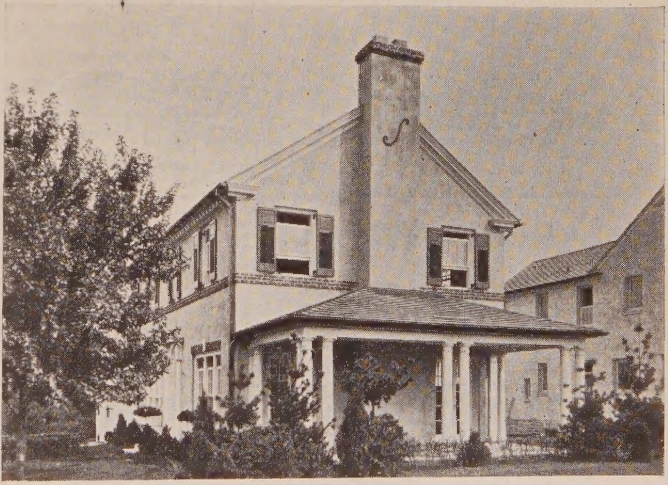
In and Near Philadelphia

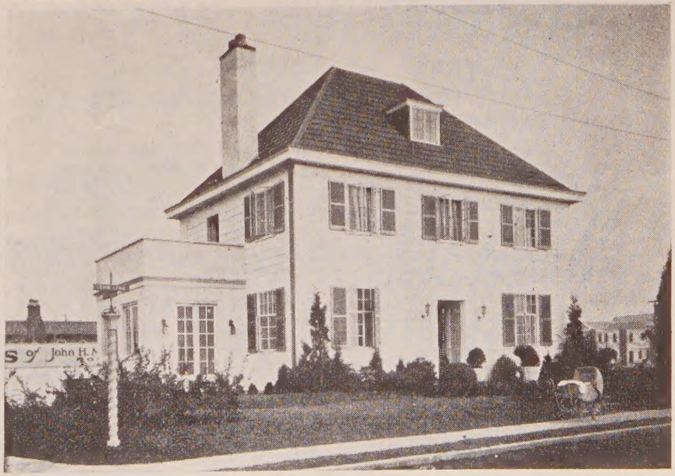


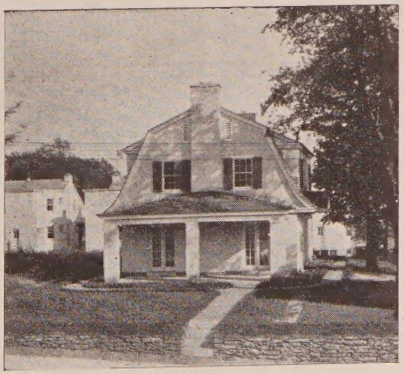
The Lower Merion Realty Co., Philadelphia, is building houses of the better kind. The topmost of the views (at the right) on this page shows four houses built in a nine-house development by this company at Ardmore, Pa. A detail of an entrance of one of the group is shown immediately above. Houses in this group were built in 1924 to sell with lot at $32,000 to $37,000. They are of concrete masonry, with buff portland cement stucco in various textures. The middle picture is an end and porch detail. This is a type of architecture very popular in and around Philadelphia. The Lower Merion Realty Co. is a complete home building organization which has selected concrete masonry for most of its recent work. Another of the company's houses—one at Haverford, combining local stone and concrete block and stucco, is shown elsewhere in these pages.

The house that appears to be of the old fashioned grooved siding (bottom right) is actually of concrete, built by and for the John H. McClatchy organization, Philadelphia—the job in this particular instance having been run by Victor H. Wigglesworth, Boston. Mr. Wigglesworth's work in concrete has been most unusual. His home in Boston is of hollow wall construction, poured in place and has an exterior drop-siding effect and a wealth of intricate form work in its entrance details and other moldings. It has been described in Concrete. *His more recently developed system is for the use of precast siding units with reinforced concrete columns to carry the loads. The house in Long Lane, Philadelphia, built in 1924, and featured as a "home electric" demonstration house, is of this precast siding construction. The detail is attractive but for all its structural quality it is in appearance a wooden house.*







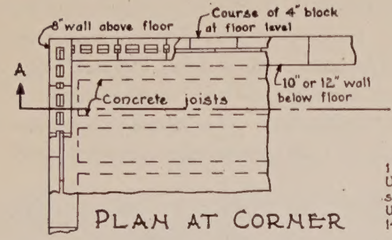


The Dutch Colonial type is still popular. This example is in Germantown, Pa.; of concrete masonry to the very peak of the gables; designed and built by I. A. Dunkelberger

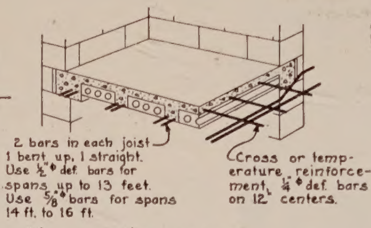
There Are Several Ways

These Two Pages

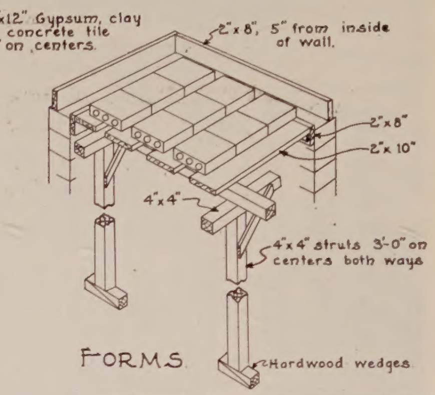
TILE AND JOIST CONCRETE FLOORS


8" wall above floor
Course of 4" block at floor level
A
10" or 12" wall below floor
Concrete joists

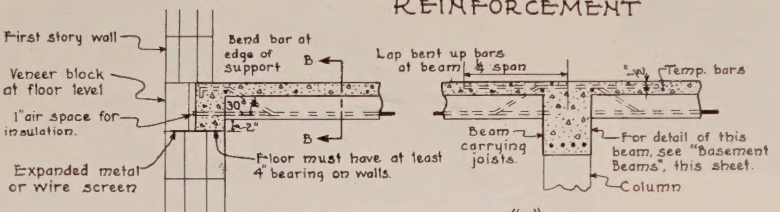
PLAN AT CORNER


2 bars in each joist 1 bent up, 1 straight. Use ½"ϕ def. bars for spans up to 13 feet. Use ⅝"ϕ bars for spans 14 ft. to 16 ft.
Cross or temperature reinforcement, ¼"ϕ def. bars on 12" centers.

VIEW SHOWING REINFORCEMENT

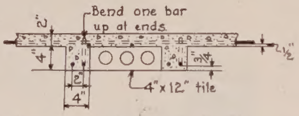

4"x12" Gypsum, clay or concrete tile 16" on centers.
2"x 8", 5" from inside of wall.
2"x 8"
2"x 10"
4"x 4"
4"x 4" struts 3'-0" on centers both ways
Hardwood wedges

FORMS


First story wall
Veneer block at floor level
1" air space for insulation.
Expanded metal or wire screen
Bend bar at edge of support
B
B
30°
2"
Floor must have at least 4" bearing on walls.
Lap bent up bars at beam
¼ span
2
Temp. bars
Beam carrying joists.
For detail of this beam, see "Basement Beams", this sheet.
Column

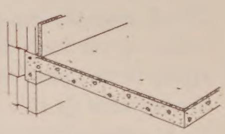
SECTION AT "A"

NOTE
This floor for clear spans only, not carrying load bearing partitions or supports for other floors. Maximum span 16 feet.

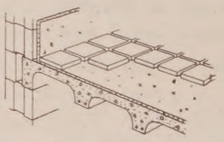


SECTION AT B-B

SURFACES FOR



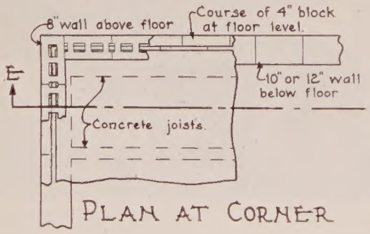
SMOOTH SURFACE



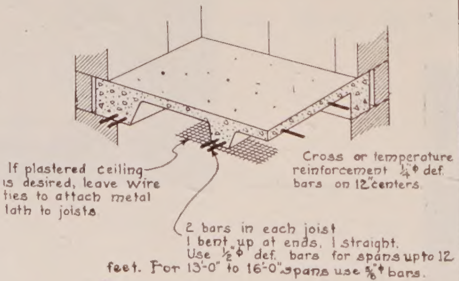
Concrete tile, any color, laid in ½" bed of cement mortar. Joints filled after mortar in bed has set.

TILE SURFACE

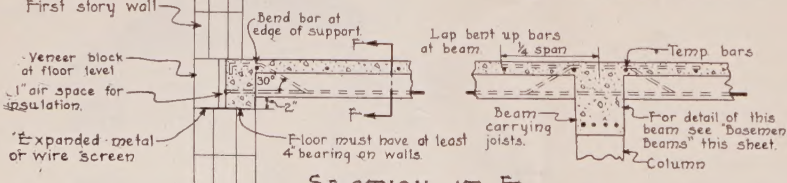
ARCH AND JOIST CONCRETE FLOORS


8" wall above floor
Course of 4" block at floor level.
E
10" or 12" wall below floor
Concrete joists.

PLAN AT CORNER


If plastered ceiling is desired, leave wire ties to attach metal lath to joists.
Cross or temperature reinforcement ¼"ϕ def. bars on 12" centers.
2 bars in each joist 1 bent up at ends, 1 straight. Use ½"ϕ def. bars for spans up to 12 feet. For 13'-0" to 16'-0" spans use ⅝"ϕ bars.

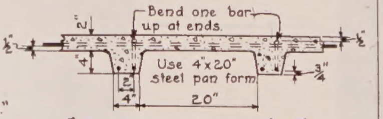
REINFORCEMENT


First story wall
Veneer block at floor level
1" air space for insulation.
Expanded metal or wire screen
Bend bar at edge of support.
F
F
30°
2"
Floor must have at least 4" bearing on walls.
Lap bent up bars at beam
¼ span
Temp bars
Beam carrying joists.
For detail of this beam see "Basement Beams" this sheet.
Column

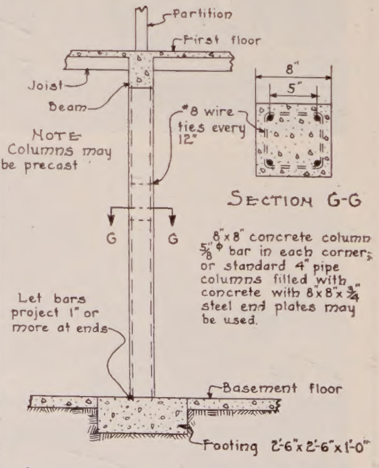
SECTION AT E.

Note
This floor for clear spans only, not carrying load bearing partitions or supports for other floors. Maximum span 16 feet.

FORMS
Use type of forms shown above for "Tile and Joist floors."



SECTION AT F-F



NOTE
Columns may be precast

8"x 8" concrete column ⅝"ϕ bar in each corner; or standard 4" pipe columns filled with concrete with 8"x 8"x ¾" steel end plates may be used.

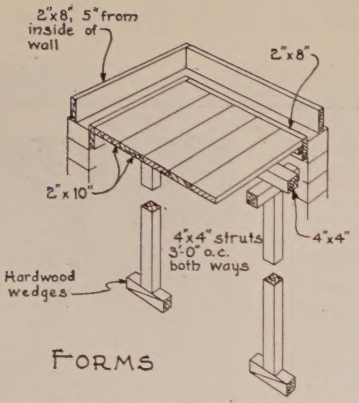
COLUMN AND FOOTING

to Build Fireproof Floors

Illustrate Some of Them

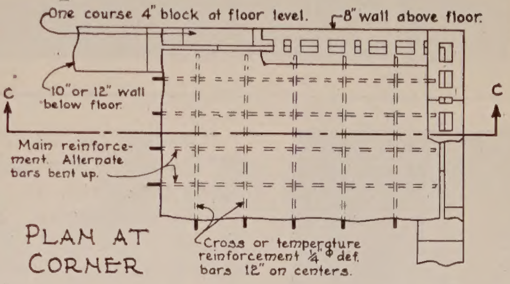
Courtesy the Portland Cement Association

SOLID SLAB CONCRETE FLOORS

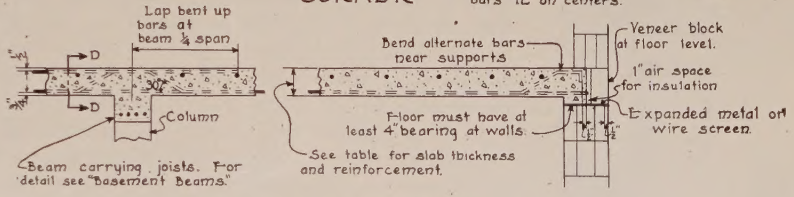

2"x8", 5" from inside of wall
2"x8"
2"x10"
4"x4" struts 3'-0" o.c. both ways
4"x4"
Hardwood wedges

FORMS

SOLID SLAB FLOORS			
Span feet	Thickness of slab inches	Dia. of round reinforcing bars	Spacing of bars inches
10	4	½	9
11	4½	½	8
12	5	½	7½
13	5½	½	7
14	5½	½	6
15	6	⅝	7½
16	6	⅝	6


One course 4" block at floor level.
8" wall above floor.
C
C
10" or 12" wall below floor.
Main reinforcement. Alternate bars bent up.
Cross or temperature reinforcement ¼" ϕ def. bars 12" on centers.

PLAN AT CORNER


Lap bent up bars at beam ¼ span
D
D
30ϕ
Column
Beam carrying joists. For detail see "Basement Beams."
Bend alternate bars near supports
Veneer block at floor level.
1" air space for insulation
Expanded metal or wire screen.
Floor must have at least 4" bearing at walls.
See table for slab thickness and reinforcement.

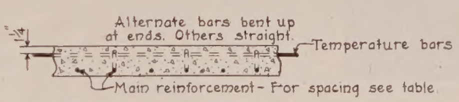
CROSS SECTION OF FLOOR SLAB AT C-C

CONCRETE FLOORS

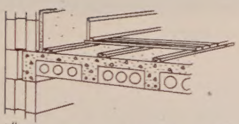
Smooth surface may be
smooth troweled finish.
Natural or grout.
Colored with mineral pigments
Enameled
Stained with brown creosote stain and waxed.
Terrazo
Linoleum

NOTE

This floor for clear spans only, not carrying load bearing partitions or supports for other floors. Maximum span 16 feet.


Alternate bars bent up at ends. Others straight.
Temperature bars
Main reinforcement - For spacing see table

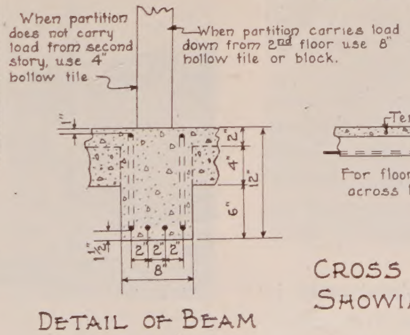
SECTION D-D



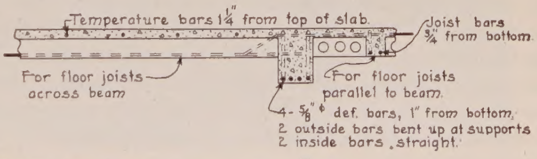
⅞" Narrow wood flooring nailed to 1"x3" sleepers on 16" centers. Sleepers are nailed to concrete soon after it has been placed.

WOOD SURFACE

BASEMENT BEAMS
FOR RESIDENCE FLOORS


When partition does not carry load from second story, use 4" hollow tile
When partition carries load down from 2nd floor use 8" hollow tile or block.
4
12
6
2
2
2
8"

DETAIL OF BEAM
SOLID SLAB SHOWN
Dotted line applies to joist types only.

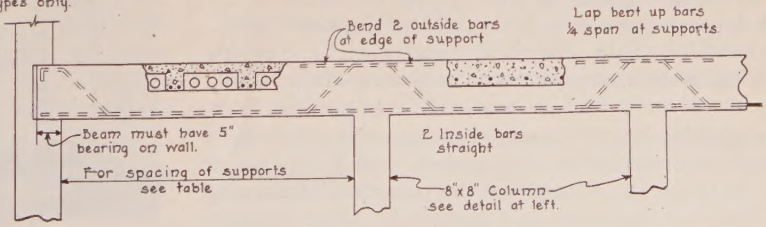

Temperature bars 1¼" from top of slab.
Joist bars ¾" from bottom.
For floor joists across beam
For floor joists parallel to beam.
4 - ⅝" ϕ def. bars, 1" from bottom,
2 outside bars bent up at supports
2 inside bars straight.

CROSS SECTION OF BEAM SHOWING REINFORCEMENT

NOTE

Use beams where floor joists are not carried by basement partitions. Also under any first floor partition which carries load down from second floor and is not supported by basement partition. Beams must be placed in one continuous operation.

SPACING OF SUPPORTS FOR BEAMS		
When side span of floor carried by beam is	Two Story houses space supports not more than	One Story houses space supports not more than
10' or less	7'-0"	10'-0"
11'	6'-9	9'-9"
12'	6'-6"	9'-6"
13'	6'-3"	9'-3"
14'	6'-0"	9'-0"
15'	5'-9"	8'-9"
16'	5'-6"	8'-6"


Bend 2 outside bars at edge of support
Lap bent up bars ¼ span at supports.
Beam must have 5" bearing on wall.
2 Inside bars straight
For spacing of supports see table
8"x8" Column see detail at left.

ELEVATION OF BEAM SHOWING REINFORCEMENT

Concrete With Native Stone

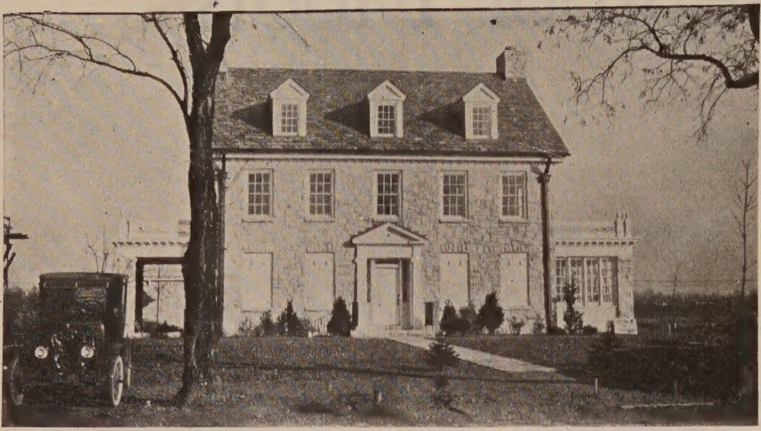


Fig. 1—Home of Charles P. Strohe, River Drive, Harrisburg, Pa., built of cinder concrete block and native stone.—C. J. Lapley, architect; W. S. Miller, builder

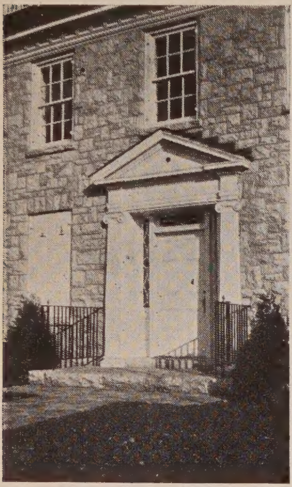


Fig. 3—The combination construction as seen in the garage

If some of the concrete enthusiasts would abandon the idea of "a whole loaf or none" their sales opportunities would be vastly broadened.

Let's have the best houses possible under local conditions. Concrete can meet more various construction and architectural demands than any other material and it can eliminate a half dozen other materials in various uses about the house—no doubt of that. But—one of the things that makes life endurable is that people aren't all alike in their personal tastes and their means to gratify those tastes.

In some parts of the country native materials cry out to be utilized; they have been utilized for generations; people are accustomed to them; are justly fond of them and their continued use makes Philadelphia, Boston and Southern California pleasantly different from each other.

In Philadelphia stone walls are a tradition and Philadelphia has many beautiful stone walls. The newer economics of construction are driving out the stone. Concrete takes its place but still some stone can be retained along with the concrete as John H. McClatchy is doing acceptably.

Pictures show a type of masonry construction which has some right to become popular in the vicinity of Harrisburg, Pa.

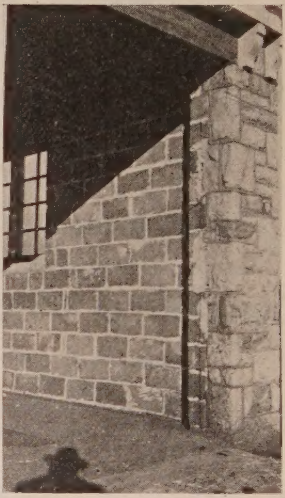


Fig. 2—Entrance detail, Strohe residence, Harrisburg

A white local stone is available in large quantities, at a reasonable price, and native stone masons who take pride in their craftsmanship are also available, so many of the higher class suburban residences are built of this material.

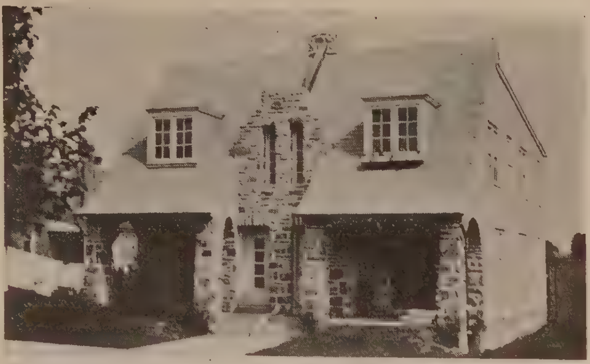
In order, however, to secure the advantages of concrete masonry construction such as straight interior walls, freedom from lathing and furring, speed of erection, warmth and dryness, together with the advantages of stone masonry construction, which, in this locality, are its traditional popularity and its substantial appearance, a combination of these two building materials is used.

The house illustrated is built of the white local stone in random ashler and backed up with 12 in. and 6 in. cinder concrete block. The thickness of the exterior wall is thus held at 18 in. throughout the job. Where the width of the stone is approximately 6 in., 12 in. block backup is used. Where the width of the stone is approximately 12 in., 6 in. block backup is used. A strong bond between stone and block is thus secured.

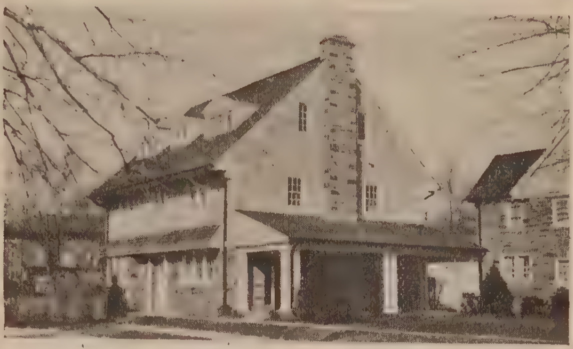
While combinations of concrete masonry with other types of masonry construction are not unusual, this is the first, or at least one of the first examples in the vicinity of Harrisburg where block has been used as a backup for stone masonry construction.

The insulating properties of cinder concrete block provide a wall which is warm and dry as compared to a solid 18 in.

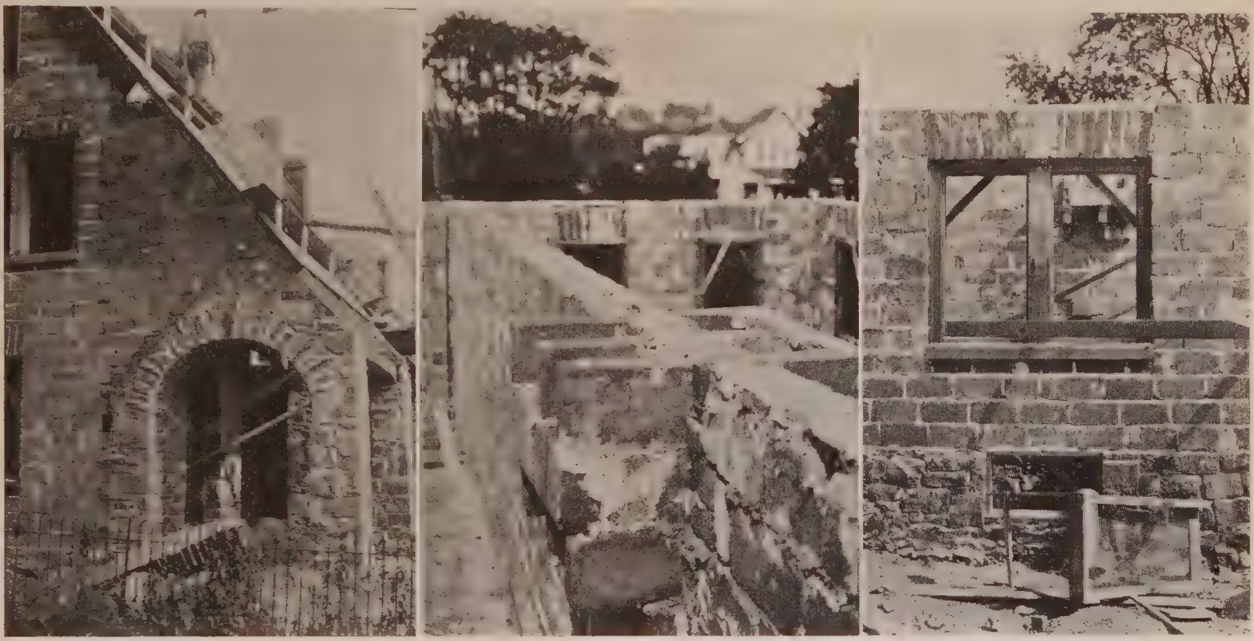
Figs. 4 and 5—Duplex house on Durham Road, Germantown, showing how John H. McClatchy, Philadelphia builder, uses native stone with concrete masonry units



Here again is an example of the attractive use of local stone with concrete masonry units—this time in Wilmington, Delaware; designed and built by Charles W. Greer



House built by Lower Merion Realty Co., Philadelphia, at Haverford, showing an attractive result by combining natural stone with concrete masonry and stucco



In the construction views, note the four-inch block above the windows with a tapered 8 x 8 x 16 block for a key while the block over the jambs are cut to form a skew back for the flat arch. This is a twin house. The fireplaces coming back to back, the chimney is carried on the party wall and block are corbeled out, as shown in the center of the three views above, until the necessary area is reached

stone masonry wall. The uniformity of block sizes can be utilized to provide a wall which is level and plumb on the interior face, a happy change from the standpoint of the plasterer. The necessity for building into the wall wood nailing blocks for receiving trim is obviated when cinder concrete blocks are used. A detail of a corner of the garage shows the combination construction.

Charles P. Strohe will occupy this house on River Drive, Harrisburg, Pa. W. S. Miller, Harrisburg, Pa., is the contractor and C. J. Lapley, Harrisburg, Pa., the architect. Neither the architect nor the contractor alone would have been willing to adopt this type of construction. Working in conjunction, however, they worked out this type and W. S. Miller, the contractor, is quite proud of his share in it.

Lime Mortar

The National Lime Association has just issued a bulletin in the form of a booklet entitled *The Binder in Your Wall*, a handy guide for architects and contractors including a summary of the latest information on lime mortar.

The booklet which is 3⅞ in. x 8⅞ in., 24 pages, is well illustrated and contains material of interest to all who build with brick or stone. It contains short form specification clauses suitable for direct incorporation for architects in their master sheets and handy tables for the use of the contractor. Copies may be obtained from the National Lime Association, 918 G. St., N. W., Washington, D. C., or from any of the district offices of the Association.

In Detroit

What Davey Jones, once famous ball player is doing with the shovel in the picture down below is probably not very important, but it was more important that, according to preliminary estimates, he saved considerable money by using concrete masonry for the multi-dwelling structure being completed for him at Glendale and Lawton avenues, Detroit

The building is of cinder block and stucco instead of the usual 4 inches of brick veneer over kindling wood of which thousands upon thousands of dwellings in Detroit are built. But Detroit, especially since concrete masonry really began to take hold on Detroit, has been trying to live down its name of a veneered city. Solid concrete masonry walls are more and more common

Mr. Jones' builder is the W. S. Pocock Co.—architect, Otto Yokes

Harry R. Miller, subdivider, who plans, finances, builds and sells houses—usually before they are finished—was one of Detroit's first builders to sell himself on cinder concrete masonry. The little story and a half house—two rooms up and four rooms and tile bath down—is one of a series of his first houses of cinder concrete block. Since then he has done larger ones with 8-in. concrete masonry all the way up into the gables. A detail of one of these is shown built from "The New York House" plan, enlarged, as "demonstrated" at a New York house show. Mr. Miller is "strong" for cinder concrete block houses — easy to sell, nailability, speed of erection and economy—by far the lowest cost for any construction of comparable value. Mr. Miller uses not only steel basement sash for economy but steel casements in preference to wood for the same reason. He says they are cheaper than wood in the walls—windows and labor considered—and are stronger and more nearly fireproof. Miller sold the Detroit Building Department on using 8-in. cinder block for foundations instead of 12-in. as previously required for all masonry foundations. He did it by getting a permit to build a one and one-half story dwelling on an 8-in. basement wall with 12-in. pilasters every 10 ft. This allows a wall one-third less in thickness, thus saving the public about $100 on a 24 x 30 basement. Ground has just been broken for another group of 20 high class residences which will form part of a considerable housing development by Mr. Miller

Stucco on Block, on Frame and Block Without Stucco

At the left is a concrete masonry home in a beautiful setting on Parkside avenue, No. 18225, Detroit, in a new section close by the Detroit Golf Club, that is building up attractively. C. E. Reichle is the architect and builder; the the owner, H. C. Herbst

Next best to solid masonry is a well built frame house covered with metal lath. The house in two pictures below is in attractive Huntington Woods district of Detroit. Gordon R. Walper is architect, builder and owner

At the left is concrete masonry with no mantle of stucco—two houses on York near Salem Road, Huntington Woods, Detroit. A. H. Cornelius is the architect and builder of both houses. They are a new and distinctive note in a residence section now very popular and attractive

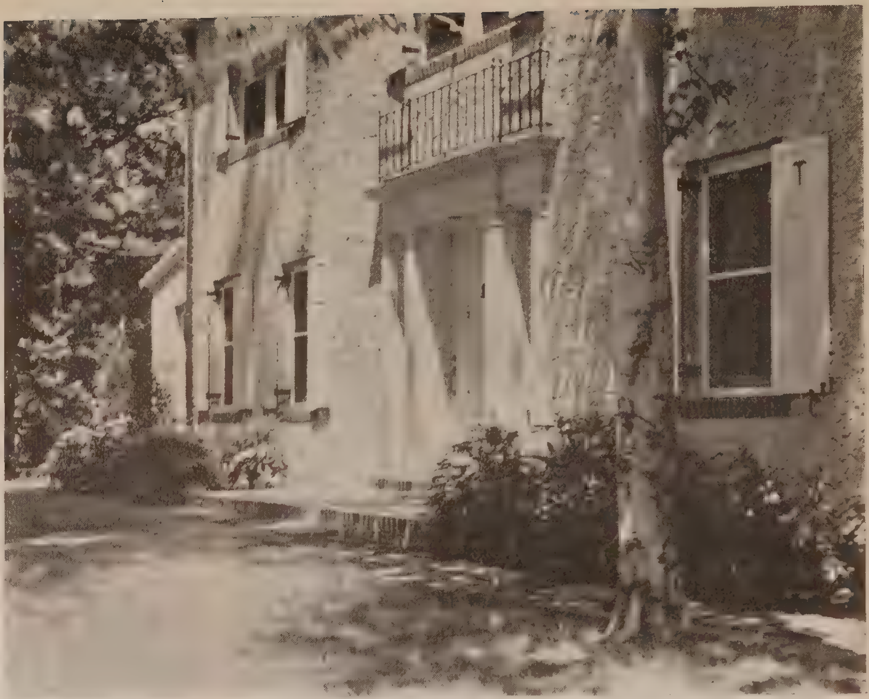


Fig. 1—Entrance detail J. W. Johnson's house, Maplewood, N. J., Kenneth W. Dalzell, architect

Cement Man and His Architect, Both Build of Concrete

J. W. Johnston, assistant general manager of the Portland Cement association for Eastern territory, practices as he preaches—a degree of sincerity in construction matters that is always hopefully looked for and not always discovered. His house, in Maplewood, N. J., shown in the accompanying illustration, represents the first use by his architect, Kenneth W. Dalzell, of concrete masonry, and this is of special interest because Mr. Dalzell, at that time on the point of building a home for himself, chose concrete masonry also for his own house, after selling himself on its economy and construction advantages in building for Mr. Johnston. Pictures of Mr. Dalzell's house under construction are also shown.

Figs. 2 and 3—Exterior and interior Mr. Johnston's house

The foundation walls of the Johnston house are of 12 in. Zagelmeyer block with a 1:3 mortar coat and asphalt brush coat supplemented by drain tile around the footings leading to a nearby brook. Walls above grade are of 8 in. tamped block with portland cement stucco. This was a three coat job, doubled up, as the plasterers say, the second coat being applied right over the first coat the same day. The final coat was applied after the former coats had time to set and dry out thoroughly in accordance with the recommendations of the American Concrete Institute. No color pigment was used. White cement and yellow sand give a very soft tone in the final coat.

The texture was obtained by careful manipulation of a steel trowel which was held at a rather sharp angle to the wall surface so that a slight tearing effect would result by the upward stroke—incidentally this was the first attempt by the plasterer who did the work to obtain such a finish, yet the result is attractive and in all respects satisfactory.

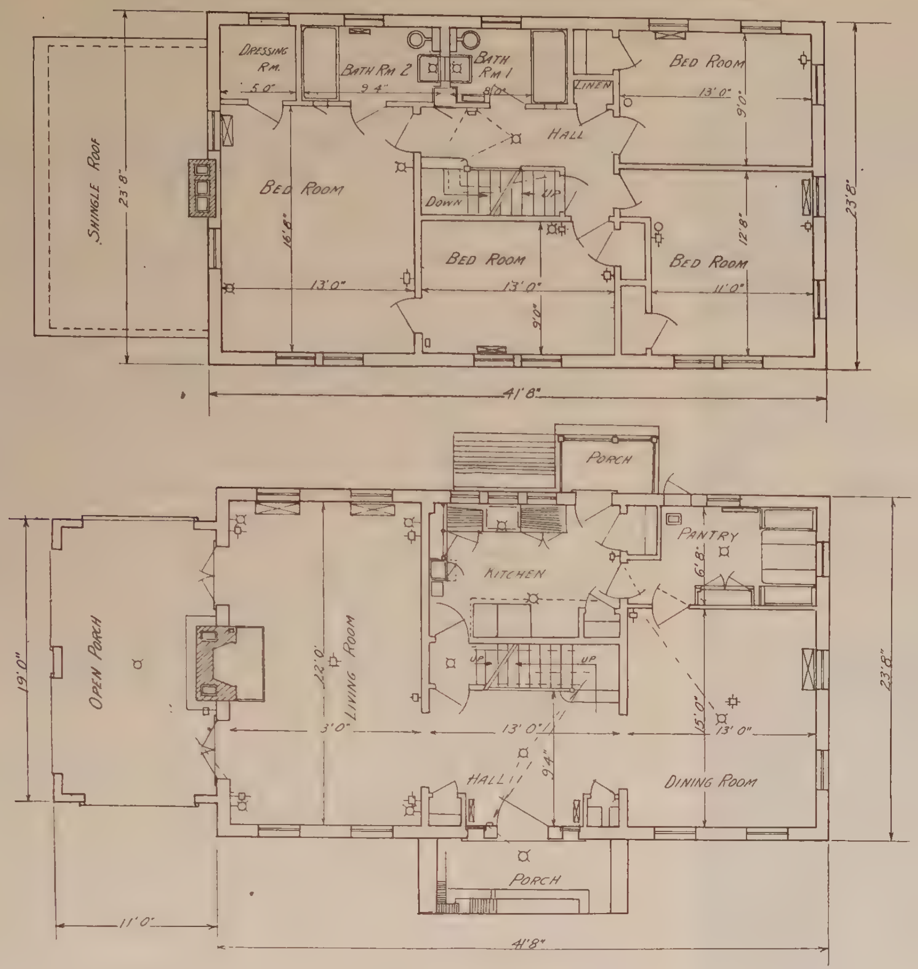
There are several interesting features which add much to the character of the design, aside from the stucco testure. Green concrete roofing tile are used on both the house and the two-car garage, the latter being constructed of the same material as the house and covered with stucco in the same textural finish. Inserted in the masonry courses beneath several of the windows are substantial brackets for removable flower boxes. A wrought iron balcony railing relieves somewhat the almost austere simplicity of the entrance-way.

Concrete brick were used around the windows in place of fractional block. Reinforced concrete lintels were used over the windows. Sills are of red clay brick, set rowlock fashion. Space between frame and sill was very carefully caulked.

Flashings, down-spouts, etc., are of copper and overhang of eaves metal lathed and plastered with portland cement mortar, for fire protection.

A study of the floor plans reveals an interior designed for comfort in living, and convenience and economy in the conduct of household operations. Interior decorations and furnishings are in accord with the Colonial effect of the exterior.

"After careful analysis and observation of all sorts of house construction, I am more than ever convinced that I have absolutely the best house for the money," declares Mr. Johnston. "I have a most comfortable and attractive home, I don't need to worry about painting and other upkeep bills,



Figs. 6 and 7—Floor plans, Mr. Johnston's house

and I enjoy the lowest insurance rate which has ever been written on dwellings in my town."

The house is furred and plaster applied on wood lath. Wood joist floor was used with double flooring.

Sylvester Brothers of Maplewood, were the contractors in charge of the construction of both Mr. Johnston's and Mr. Dalzell's residences.

Figs. 4 and 5—Mr. Dalzell's own house under construction

Combining Sand and Slag

As an indication of the trend of endeavor to produce better concrete on the job, the following instructions for combining sand and slag are of interest. These instructions are sent by the Ferro Concrete Construction Co., Cincinnati, Ohio, to superintendents in the field.

Fine aggregate—No. 1 washed sand.

Coarse aggregate—No. 34 slag.

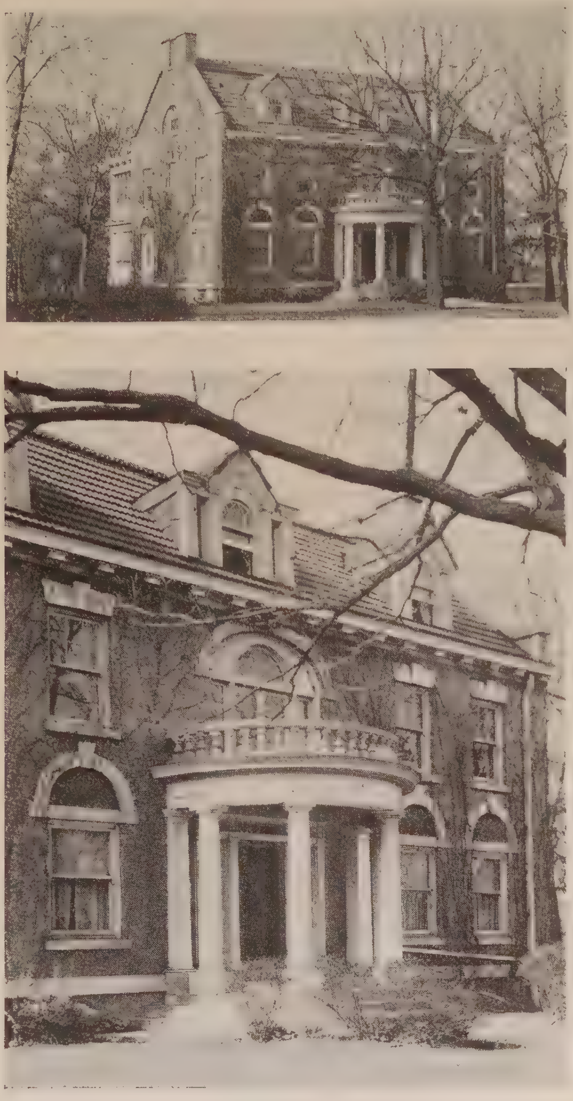
In place of 1:2:4 concrete use the following mix: 1 part cement, 2½ parts sand, 4½ parts slag. Use not more than 7½ gallons of water per sack of cement.

In place of 1:1½:3 concrete use the following mix: 1 part cement, 1¾ parts sand, 3½ parts slag. Use not more than 6½ gallons of water per sack of cement.

The above quantities of water are for *dry* materials. If the sand or slag is wet, the quantity of mixing water must be reduced so as to keep the consistency of the freshly mixed concrete the same. The amounts of water given above will give the same consistency for both mixes. This consistency will give a slump of from 5½ to 6 in., using the cone test.

If the cone mold for making the slump test is available, frequent tests should be made to see that the consistency of the concrete is not wetter than given above. If the slump is greater than 6 in., less water should be used. If the slump is less than 6 in., so much the better; do not use more water unless the concrete is too stiff to work properly. Note that the strength of concrete depends upon the amount of mixing water used; the less the water, the stronger the concrete, as long as the mixture will work properly. Use as dry a mix as you can handle on the job.

Remember that each excess pail of mixing water may decrease the strength of the concrete as much as if two pails of cement had been left out.



Built for President of Beloit College in 1912

Beloit President's House of Block

In 1912, when the trustees of Beloit college decided to build a home for the president of the institution near to the college buildings, in the heart of the best residential section, the use of concrete block for the construction of houses was practically unknown in that part of the country, and the architects, Dowling and Miller of Chicago, naturally specified brick walls throughout. Estimates of cost, submitted by various contractors, were much higher than the trustees desired to pay, the lowest bid offered being about $18,000. A live-wire products manufacturer, George Leuty, hearing of the situation, approached the trustees on the subject of using concrete block and portland cement stucco and was able to quote prices on block and other concrete work, such as precast sills, belt course, etc., which brought the total cost of construction down to about $12,000.

Such a saving seemed incredulous and naturally indicated the use of a material much inferior in quality to what had originally been specified.

The possibility of such saving, however, held their interest, and by sound arguments in its favor, concrete masonry carried the day, and contracts were let for the erection of this house.

The block are of a two-piece type with air spaces running horizontally. The total thickness of the wall is 10 in.

At that time the so-called texture finish of portland cement stucco was unknown, the pebble dash being strongly in vogue. This surface was consequently used, but due to the fact that the only pebbles obtainable for the dash coat presented a poor appearance, the entire surface was covered with a thin coat of rich cement stucco. Today it is impossible to find a single crack in the wall, stucco, or even in the thin coat applied to the pebbles.

The sills are all precast concrete made by the same company which manufactured the block. The products plant is now owned and operated by Leuty Bros. who are still doing an excellent business and turning out a high grade product.

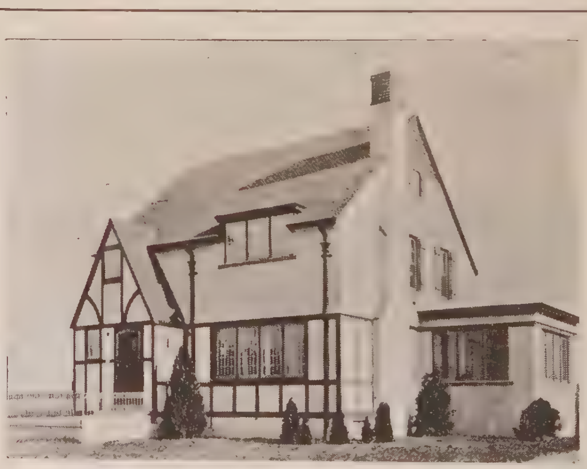
The lintels, belt course and arches over the windows were poured in place. Today such trim would probably be precast as were the sills.

The house was first occupied by President Eaton, and during his term of 10 or 11 years' occupancy he became a very strong enthusiast for concrete masonry houses. President and Mrs. Eaton were interviewed at various times by the products manufacturer and others interested in this type of construction, and they invariably had nothing but praise for this concrete block house.

Even with its high ceilings, large reception hall and open stairway and a northwest exposure, this large house has been kept warm through Wisconsin's cold winters very economically.

The only objection that the occupants had was that the squirrels, which always live in large numbers in a college town, were able to cling to the pebble dash with their claws and scale the wall.

The present president, Irving Maurer, and family have occupied the house less than a year.



Detroit Cartoonist's Cinder Block House

Bert Thomas, Detroit News cartoonist and creator of Mr. Straphanger, succumbed to his own paper's house building publicity and built from the Mr. Straphanger house plans (see CONCRETE, *October 1923) considerably enlarged and modified with the addition, among other things, of a sun room. The house is at 886 Washington Road in the Grosse Pointe section of Detroit; built of cinder concrete block by Ricardo D. French, from Detroit News architectural service plans.*

Making Concrete Basements Dry

What to do to remedy or prevent a leaky basement or cellar is a question asked all too often, and it is justly cited that the number of inquiries from owners seem to point to the fact that many contractors and builders are not devoting sufficient attention to the very important matter of securing dry cellars in every house they build. The question is one of the many important ones which home owners ask regarding building construction. The forms of concrete used only in cellar walls are poured concrete, concrete block, and brick. Where the concrete in the units employed in the walls is a dry tamped concrete, such as rough block sold for foundations, it is likely to be somewhat porous. It is cited in *Contractor's Atlas*, published by the Atlas Portland Cement Co., from which the accompanying illustrations are reproduced, that of the types of cellar walls mentioned, the poured concrete can be made watertight most conveniently and economically. The block wall is entirely satisfactory, even in very wet locations, when properly handled.

While concrete which is carefully proportioned, well mixed, and properly deposited will be sufficiently watertight to meet ordinary conditions, there are actual difficulties met with particularly in concreting below grade where watertight walls and floors are all the more necessary. The existence of construction joints, the improper placing and spading of the concrete, and insufficient mixing are among the uncertain factors. Rich mixtures are necessary, the ones most commonly used being 1:1½:3 mix or 1:2:3. When handled properly, these mixtures will insure watertight walls and floors.

INTEGRAL WATERPROOFING

Although the first method which suggests itself to the builder is the use of integral waterproofing, which is mixed with the concrete, this does not always accomplish what is expected, and will not take care of improperly made construction joints, seams, air pockets, or stone pockets. Integral waterproofing will not compensate for lean mixtures or poor materials nor for poor workmanship in the fabrication of the concrete.

Hydrated lime is quite efficient as an admixture, if used in an amount of from 4 to 8 lb. per bag of cement. This tends to make the concrete more plastic, so that it will settle into place better and give a denser mass, acting as a void filler in addition to its lubricating properties.

THE USE OF DRAINS

Another method suggested to insure dry basements is the use of drains, a typical example of which is shown in Fig. 1. This sketch shows very clearly the suggested method for a drainage system of broken stone trenches and drain tile around the exterior of the wall. These outside drains are sometimes supplemented by drains along the inside edge of the footing on four sides of the cellar. In addition, a deep semicircular groove is provided in the concrete floor, about 1 ft. from the walls. This groove takes care of any water that might come through at a localized leak, thus allowing the water to run down the groove to the lowest part of the cellar where connection is provided to the cellar drain.

Where the cellar floor is below the level of the sewer, so that no connection can be made for the cellar drain, automatic cellar drainers can be used, as illustrated in Fig. 2. An automatic cellar drainer must be installed in a sump, and when the water rises to a certain level, it is operated by city water pressure on a principle similar to an injector or ejector. The drainer lifts the water out of the sump to a connection with the sewer, but its operation involves considerable waste of city water if frequent use is necessary. It is better to avoid their use by providing watertight walls and floor.

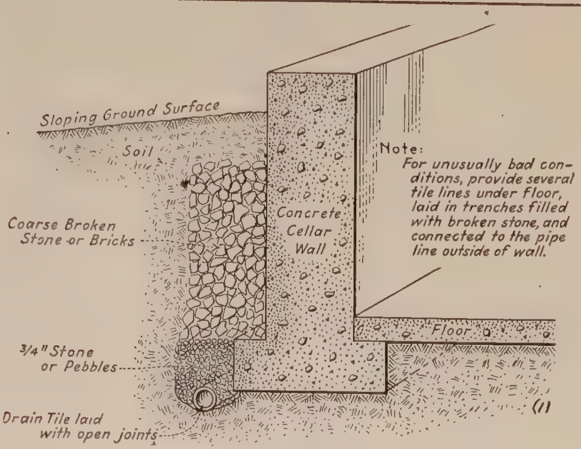

Sloping Ground Surface
Soil
Coarse Broken Stone or Bricks
Concrete Cellar Wall
Note: For unusually bad conditions, provide several tile lines under floor, laid in trenches filled with broken stone, and connected to the pipe line outside of wall.
Floor
3/4" Stone or Pebbles
Drain Tile laid with open joints
(1

Fig. 1—Drainage system of broken stone trenches and drain tile

Other precautions which aid in insuring dry basements include supplementing the drainage systems or waterproofing by proper grading of the surrounding ground so that all water will be conducted away from the house. Proper terracing, a compact fill next the cellar walls and the placing of side walks next to the cellar walls are precautions which tend to protect the walls from surface water.

WATERPROOF COATINGS

Waterproof coatings commonly used include cement mortar, paraffin and silicates, and bituminous coatings. Obviously, to secure the best results with coatings, it is necessary to apply them on the outside surface of the wall next to the earth so that the water pressure, if any exists, tends to press

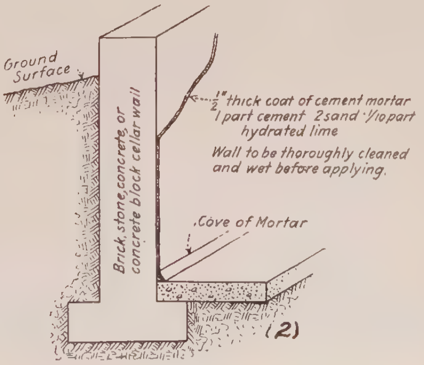

Ground Surface
Brick, stone, concrete, or concrete block cellar wall
½" thick coat of cement mortar 1 part cement 2 sand 1/10 part hydrated lime
Wall to be thoroughly cleaned and wet before applying.
Cove of Mortar
(2)

Fig. 2—The use of a cement mortar coat for dampproofing the inside surface of a cellar wall. Only in rare cases can this be used where there is any considerable amount of water to be taken care of

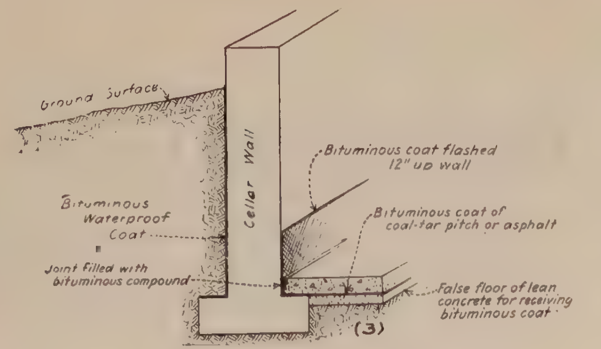

Ground Surface
Cellar Wall
Bituminous coat flashed 12" up wall
Bituminous Waterproof Coat
Bituminous coat of coal-tar pitch or asphalt
Joint filled with bituminous compound
False floor of lean concrete for receiving bituminous coat
(3)

Fig. 3—Method used for making watertight existing walls. For new work, it is best to have the bituminous coating or membrane in the floor extend across the top of the foundation under the wall. This makes a complete seal

the coating or membrane into tighter contact with the wall, whereas if the coating were placed on the inside surface, it would tend to be forced off the wall. The coating or membrane on the outside of walls necessitates that the excavation be sufficiently large to allow space for working outside, or the sloping of the sides of the excavation at an angle which will provide this space.

A cement mortar coating is easily applied, and is probably more universally used. It is very effective in resisting a moderate amount of water. The principle difficulty cited in this use of portland cement mortar is to strike a balance between richness of mixture and hair cracking or checking. Where a mixture of 1 part of cement to 3 parts of sand should not hair crack or check, the mixture is rather lean for waterproof coating. On the other hand, a mixture such as 1:1 or 1:2, is much more dense but has a tendency to hair crack or check, lessening its value as a waterproofing. A ½-in. thick coating of cement mortar applied to the outside surface of the wall may be relied upon alone, where ground water conditions are not especially bad and dampness only is to be guarded against. A mixture of 1 part of cement, 2 parts of sand, with the addition of 5 lb. of hydrated lime per bag of cement, can be used to good advantage on the outside of every concrete block wall, regardless of conditions, to take care of possibly defective joints, if for no other purpose. For more extreme conditions than mere dampness, the mortar coat should be given a bituminous coating.

Paraffin is either applied cold, when dissolved in volatile solvents, or hot, when the surface can be warmed and the paraffin driven in with heat. In either case, the paraffin remains in the pores of the masonry material and seals them against the entrance of water. Paraffin may be applied to any masonry material, but the silicate washes are useful principally with mortar or concrete, since their action depends upon a chemical combination with the cement. Sodium silicate, commonly known as waterglass, or magnesium fluosilicate are the materials most used of the silicate group. Both paraffin and silicate treatments find their principal use for dampproofing and waterproofing above grade where a colorless coating is essential.

For waterproofing walls below ground surface where appearance is not a consideraiton, bituminous coatings are commended. If the coating is properly applied, it will form an absolute seal against the entrance of water or dampness. Included in this class are coal tar pitch and asphalt. They are usually applied hot, being mopped on in a manner very similar to the application of bituminous roofing. Bituminous paints and mastic coatings may be obtained from the manufacturers and may be applied cold. A necessary requirement for the application of bituminous coatings is a dry, fairly smooth surface. If the walls are rough, as in the case of brick, stone, or concrete block, a coat of portland cement mortar is first plastered on the wall to give it a smooth surface for the bituminous coating. In some cases, pitch or asphalt may be applied directly to the wall without further treatment. But a priming coat, consisting of bitumen thinned with gasoline or kerosene to the consistency of paint and applied with a brush, is recommended. This priming soaks into the pores and gives a good bond for the coatings which are usually applied about ⅛ in. thick. Any number of coats may be given until the entire wall surface has a shiny appearance, denoting a complete filling of the pores and a film or coating on the surface.

Bituminous membranes are very similar to bituminous coatings, except that the waterproofing seal is much thicker and has considerable strength and elasticity against cracking due to settlement of the wall. The membrane consists of one or more plies of waterproofing felt, mopped on with pitch or asphalt. The wall is coated with the hot bituminous material and the felt applied over this, then another coating of the pitch or asphalt and another layer of felt, and so on, until the membrane is built up to the required thickness. Simple bituminous coatings are usually sufficient for ordinary small work, such as in house construction, where the membrane system is rarely used.

Making Existing Cellars Dry

It is pointed out that one of the most troublesome and difficult problems met with by the builder is the repair of existing cellars so as to make them watertight. Each cellar presents a different problem, because in some cases the water comes up through the floor, in other cases at the joint between the wall and floor, and in still others through the walls. In one instance, it will be merely dampness that is to be eliminated, and in another, free water will find its entrance into the cellar. As a general rule, the same method used for insuring a dry cellar in a new house must be used in the repairs of existing leaky cellars, with added complications due to the fact that the back fill on the outside of the wall is already made, grading is done, and in most cases, lawns and planting exist around the walls. In the interior of the cellar, the problem is further complicated by the existence of plumbing, the heater, and other equipment.

Treating Existing Walls

Two methods of treating existing walls are shown in the accompanying illustrations. The application of a plastered

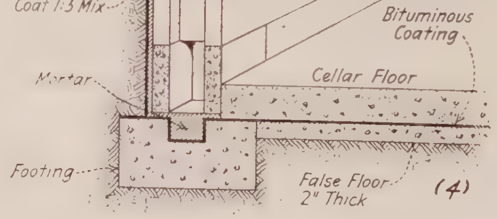


Fig. 4—Completely waterproofing a concrete block cellar wall and concrete floor. For the very best quality of work, a bituminous membrane of one or two plies of tar paper or felt would be used in place of the bituminous coating, and a protective layer of cement mortar would be placed over the bituminous membrane to protect it

coat of cement mortar on the inside surface of the wall is the simplest solution of all, but unfortunately, it can be used only for curing dampness or slow seepage. Where free water is coming through the wall, the mortar coat is forced out after it is applied and before it has a chance to harden.

Installing a bituminous waterproof coat or membrane on the outside, or the installing of a tile drain, as in the case of a new wall, will necessitate digging down all around the wall so as to expose the outside surface. Where the digging is permissible, it would probably be easier to apply rhe bituminous coating.

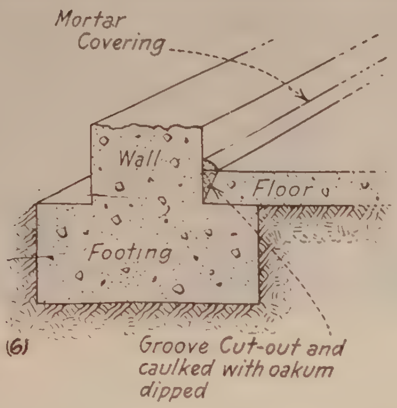


Fig. 6—Curing a leak at the junction of wall and floor by cutting out and caulking

LEAKING FLOORS

Leaking floors present even more troublesome problems than walls, and one of the principal causes for leaks in cellar floors is the practice of some builders to use a very lean cinder concrete for the base, covering this with a ½-in. or 1-in. top of cement sand mortar. The cinder concrete ordinarily used for cellar floors is practically valueless for keeping out water, and consequently, a 1-in. top coat must be relied upon as a seal against the water. Where a good bond is not secured between the cinder concrete and the top coat, a common result is the cracking of the top coat by the water, which causes considerable annoyance. For cellar floors where there is any chance of excess ground water, no cinders should be used in the concrete, the practice recommended being the use of a stone or gravel concrete of good quality, making the mixture 1 part of cement, 2 parts of sand, and 3 parts of pebbles or stone. The thickness should be not less than 4 in.

Where the floor has a porous weak surface, showing merely dampness or very little free water, the application of sodium silicate or magnesium fluosilicate may make the floor watertight. These materials come in the commercial floor hardeners now on the market. To meet more severe conditions, either a new floor must be laid on top of the old floor or the old floor torn up and a new floor laid. Where space will permit, a bituminous coating of 1 or 2 ply bituminous membrane should be provided over the top of the old floor before laying the new floor. This will act as a seal in case the new floor should have any defects due to improper workmanship. The thickness of the new floor should be not less than 3 in.

Where the only point of leakage in a cellar floor is at its junction with the wall, the method recommended is to cut out a groove as shown in Fig. 6 and caulking, as indicated.

In locations where the ground water conditions are very bad, and springs are encountered, with a resulting actual water pressure which tends to lift the floor, steel reinforcing must be used and the floor anchored in some manner to the walls and at pier footings to prevent the pressure from cracking the floor.

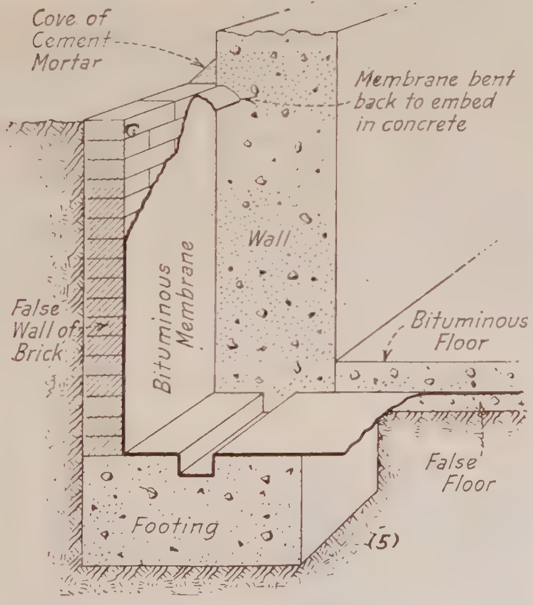
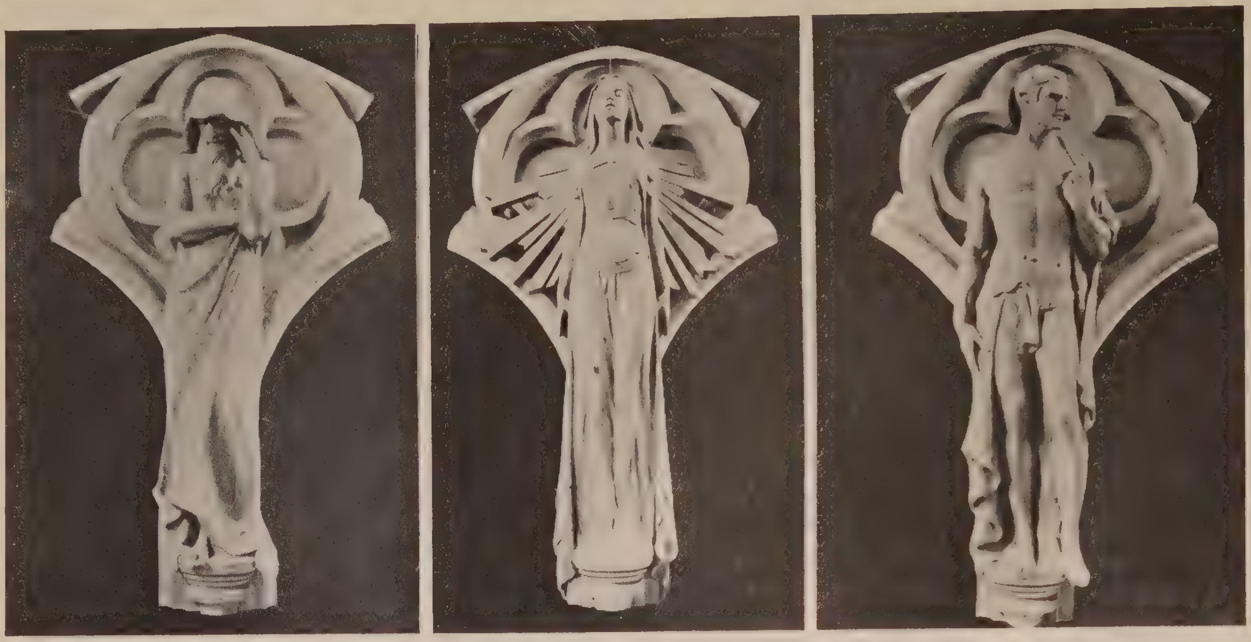


Fig. 5—A method of waterproofing a new wall when it is impossible, because of adjoining buildings or other obstruction, to get on the outside of the wall to apply the membrane. The false wall of brick may be eliminated by applying the membrane to the inside surface of the outer form, and then allowing the outside form to remain in place. The form will then act as a protection to the membrane for a considerable number of years before it rots out

A Detroit Concrete Masonry House

General and detail views of concrete masonry house at 17225 Hamilton boulevard, Detroit. Halpin and Jewell, architects; W. S. Pocock, builder for Robert W. Hamilton, the owner



Knowledge, Inspiration, Mastery—three figures in Concrete above the entrance to the Library of the University of Washington, Seattle—by Allan Clark

Concrete Sculpture at University of Washington

The use of cast concrete for sculpture is comparatively new and is becoming more general. The colossal "Black Hawk Statue" and the much more recent "Fountain of Time" both by Lorado Taft, are outstanding and well known examples, the fountain being entitled to rank as one of concrete's "seven wonders"—the other six do not come readily to mind. It was John J. Earley's long-studied and most skillful mastery of a new technique in the application of concrete to the uses of art and architecture,which made it possible, and for the result he has been paid the highest tribute by Mr. Taft, whose critical judgment is wholly concerned with results and without that bias which makes us temper the opinions of concrete enthusiasts.

Of entirely different and not so new a technique is the work that stands above the entrance to the library at the University of Washington, in Seattle—three heroic statues representing Inspiration, Wisdom, and Mastery, sculptured by Allan Clark of New York. These figures represent the most recent contributions of the Pacific coast to the art of plastic sculpture.

Inspiration is symbolized by the figure of a young woman. The eternal youth of man's inspiration, the fineness of his ideals, the guidance of inspiration in man's life are typified by the upward looking, delicate figure. Because Inspiration is the basis for all man's accomplishments, this figure occupies the central position.

To the north stands Knowledge. The age old wisdom of man's knowledge, the head bowed deep in thought, the reposeful expression of the face as though the thoughts of the ages were passing through the mind, are exemplified in the posture of an old man.

On the other side of Inspiration stands Mastery, the figure of a young man, masterful in the full strength of youth. With Mastery and health, Wisdom and Inspiration are brought to their fullest attainment.

Mind, soul and body; the three phases of life our educational institutions train, stand thus over the entrance to the building which houses man's past writings.

Mr. Clark, formerly of Seattle, is responsible for the execution of these statues in concrete. In addition to designing the model and the cast, he did the final sculpturing himself. Not only has he accomplished some really contributory work to sculpture, but he has shown again the adaptability of concrete to the finest and most delicate work as well as to the prosaic structures of our commercial life.

It is fitting that statues of concrete should be placed in our college buildings. The art and science of concrete making has become an established part of many primary, secondary and college curricula. In manual training classes, in agricultural courses, in engineering, knowledge of the principles and practices of good concrete work is being taught.

The original figures were done in clay from a plaster model,

"Black Hawk" designed by and done in concrete under the direction of Lorado Taft

"The Fountain of Time," by Lorado Taft—done in concrete by John J. Earley

one quarter size. The molds were cast from the clay models. The concrete used was an especially prepared mixture of cement and white marble aggregate. As the cement was placed in the molds it was tamped in place with pneumatic hammers to gain density and uniformity of mass.

The statues were cured in steam rooms while in the molds. The molds were then stripped away and the entire surface bush hammered with small pneumatic tools. Use of these instruments speeded the work. The statues are 8½ feet high and weigh approximately 3600 pounds each. Costs were also reduced through use of concrete for the figures.

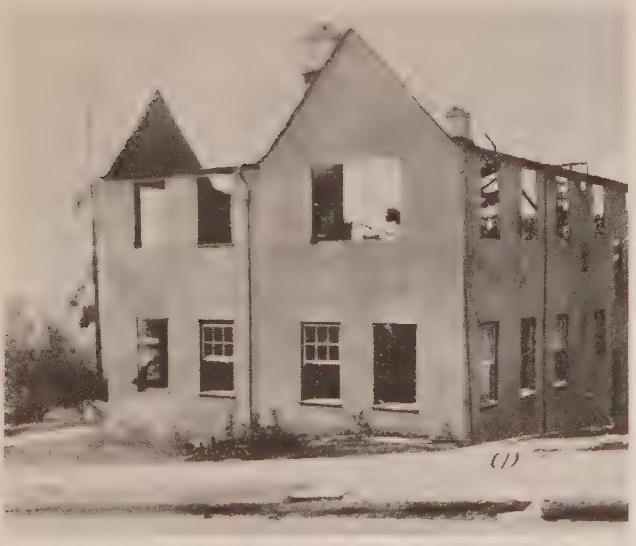
These three statues are being presented to the university by H. C. Henry, a pioneer Seattle philanthropist, and for many years a patron of the fine arts.

They will be an addition to the artistic life and atmosphere of the university. And they will also serve to demonstrate that beauty can be attained through use of the prosaic and most often thought of industrial material, concrete.

Stucco Resisted Berkeley Fire

The fire-resisting qualities of portland cement stucco walls were clearly demonstrated in a recent fire which struck a large part of the finer residential district of Berkeley, Calif. The Berkeley fire, which ranks among the great conflagrations of the United States, consumed over 600 homes and caused a total fire loss exceeding ten million dollars.

After the fire, stucco walls two stories high, with all backing burned away, remained standing, as shown in the accompanying illustrations. In several cases, the stucco was still standing, with all backing, including studding and sheathing, completely consumed. In various parts of the burned area, some of the stucco acted as perfect fire walls, shutting off effectively the sweep of the flames and protected other homes from all damage.



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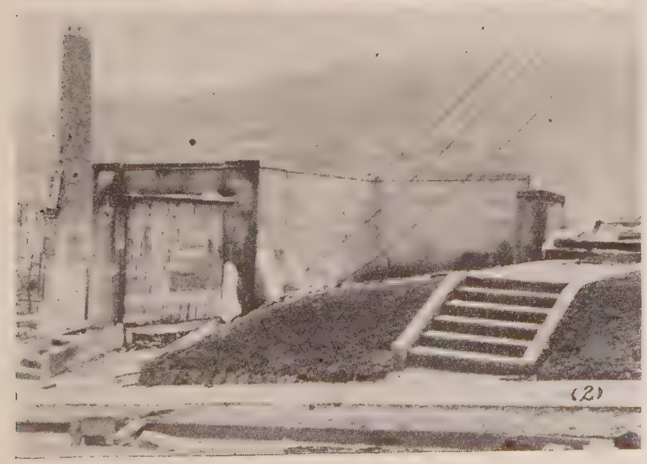

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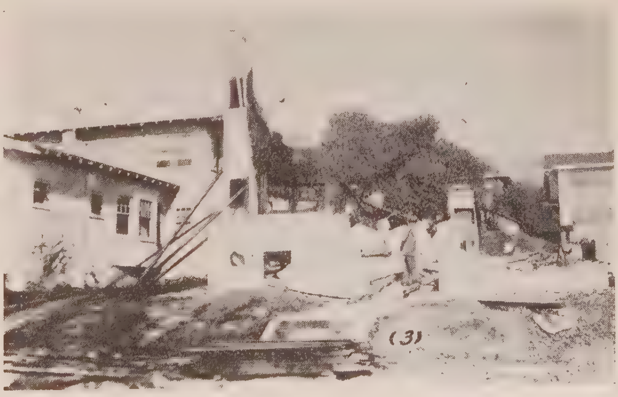

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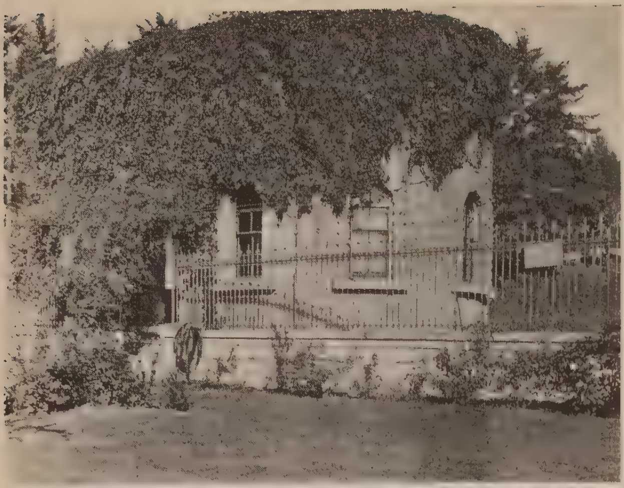
Fig. 1 (at left)—Stucco walls of house still standing after the frame construction had been destroyed by the fire

Fig. 2 (at left)—Portland cement stucco walls standing with sheathing and studding completely consumed by the fire

Fig. 3—The portland cement stucco standing in the center of this picture is two stories high. All backing was burned away, and the stucco acted as a fire wall, saving the house on the left



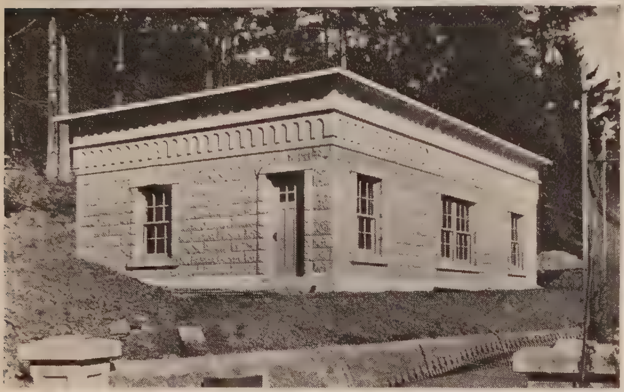


Fig. 1—The old water bureau structure whose appearance was to be imitated

Fig. 2—The result as obtained with veneer blocks cast in sand molds

Here Is "Rock Face" Made in Sand Molds

By Max Sommers

A rather unique method of construction was recently employed by the J. W. Sadler Co., contractors and engineers of Portland, Oregon, in building a concrete gate and screen house for the City Water Bureau. The building was to be erected at the existing reservoir site and in close proximity to a building of similar purpose that had been built many years previous. The existing building had a hand chipped exterior stone finish and with a view to maintaining architectural harmony the specifications for the new structure called for a similar finish. It was found, however, that due to the difference in cost of skilled labor, as between that time and the present, the cost of executing the design by a similar method would be prohibitive. Resort was therefore had to the making of a concrete precast veneer which, by the method used, produced the desired effect.

The building is of monolithic concrete construction but the exterior surface instead of being cast against the forms as part of the monolith was cast in sand molds and placed inside of the forms. The backs of these concrete veneer blocks therefore acted as the exterior form for the concrete wall which was then poured. These veneer blocks were of the size and shape of the stone blocks in the original structure and had cast in them the necessary wire anchorages to bind them to the concrete wall. After the removal of all form work the joints were properly pointed and the entire finish presented a very pleasing exterior, closely resembling that of the original structure.

Ordinary rock face block construction would not have answered the purpose on account of its very artificial appearance, but these veneer blocks, having been cast in special sand molds, presented an appearance of cut or hand chipped work that withstood very close inspection. Original patterns were in fact cast and hand chipped carefully to resemble the older structure and then from the hand chipped patterns the molds were made. There were some sixteen or eighteen full blocks, half blocks, corner blocks, sills and lintels prepared in the original and while, of course quite a number were cast from each pattern these are sufficiently scattered and intermingled so as to avoid any appearance of duplication. The objectionable feature therefore of having each block an exact duplicate of its neighbor was entirely avoided. The concrete was poured into the molds of a 1:2:4 mix and it was found that sufficient sand of the mold adhered to each block to give it quite an individual appearance. These veneer blocks, or more properly slabs, were approximately 12 x 24 in. in dimension and 1½ in. thick. They also had trimmed and bevel edges similar to that given cut stones by stone masons in the older type of work and the entire job was admired and accepted by the Water Bureau officials as entirely fulfilling the specifications. J. E. Bufton, a contractor of experience in concrete block construction collaborated with Mr. Sadler in working out the details of the method employed.

The construction company estimates as much was accomplished for $1800 by casting the blocks as would have cost nearly $5,000 by the hand chipping method. Bufton has employed this same method of sand molding with great success in erecting mile posts along the Pacific Highway.

Concrete House in the Far North

The house in the picture is along the Glacier Highway, near Juneau, Alaska, and is owned and occupied by Charles Rudy. G. Fagerson, Juneau, reports he built the house in the summer of 1922, at a cost of $5,000, using Universal double wall molds

Mr. Fagerson says that the cost of the house amounted to 10 % less than the estimated cost of frame or other combustible materials. It is 28 by 32 ft., with four rooms on the first floor, two large rooms on the second, and a divided basement. Last Christmas the owner was called by telephone and asked how he and the house were standing the weather

"Fine!" came the reply. "We are as warm as toast. With the thermometer standing at 6° below zero outside, we are letting the heat go up stairs so that we won't get too warm down stairs"

Taking the Laboratory Idea Out Onto the Job

How to Proportion Concrete for a Specified Strength

By R. R. Litehiser
RAILWAYS BUREAU, PORTLAND CEMENT ASSOCIATION

The effect of moisture in increasing the volume of a given amount of sand all out of proportion to the amount of moisture present was illustrated and described in this magazine in January.[1] Reference to the illustrations will show that this increase in volume varies with the amount of moisture and that maximum bulking occurs with a moisture content of 5% (by weight of dry sand). With a moisture content of 5% in the sands tested, the increase in volume above standard measurement amounted to over 40%, varying with the coarseness of the sand. It is readily apparent then, that ordinary measurement on the job, where a moisture content of 3% to 5% is quite common, will result in obtaining widely varying amounts of sand in different batches which are intended to have the same proportions. As uniform quality and strength in concrete are dependent on definite amounts of each of the ingredients of the mix, viz, water, cement, fine and coarse aggregate, allowance must be made for bulking of sand when damp or wet. Furthermore, in tables of proportions for specified strengths, the quantities of fine and coarse aggregate are given under conditions of standard measurement. To use these tables, therefore, variable field measurement of the aggregates must be reduced to standard measurement.

The American Society for Testing Materials, basing its action on the results of thousands of tests, prescribes the conditions of standard measurement in obtaining the unit weight of an aggregate. The sample must be room dry. The standard measure should be metal and have its height and diameter approximately equal. For fine aggregate its capacity may be 1/10 cu. ft., but for coarse aggregate its capacity should be ½ or 1 cu. ft. The aggregate is placed in the measure in three approximately equal layers, each layer being tamped or rodded 25 times with a bullet-pointed metal rod ¾-in. in diameter and 18 in. long. and any excess material scraped off when the measure is full. Aggregates so measured are said to be "dry, rodded." When "dry, rodded," a representative sample of an aggregate has a practically constant weight per cubic foot. Measurement in a "dry, rodded" condition is therefore standard.

There are three general methods of proportioning the ingredients in a concrete mixture. They may be proportioned by volume, by weight, or the sand may be measured in an inundated condition. How to obtain concrete of a specified strength by each of these methods will be discussed in turn.

PROPORTIONING BY VOLUME

Measuring the ingredients by volume is the oldest and most prevalent way of proportioning water, cement, fine and coarse aggregate, in a concrete mixture. So general is this practice that 1:2:4 or 1:2½:5 concrete is always understood to mean proportions by volume and measurement of the fine and coarse aggregate just as found on the job in a loose condition and containing whatever quantities of moisture may be present. Not only have these volumes been measured in a crude manner but the even greater effect of bulking of the sand due to the moisture contained has generally been neglected. Such measurement of the aggregate will result in considerable variation of the actual amount placed in a batch. The magnitude of this variation was illustrated by example in the previous article.

It is obviously impractical to even think of measuring the aggregates for each batch in the field in a "dry, rodded" condition. Simple tests however, made on the job, will determine the amount of each aggregate measured as found in a damp, loose condition, necessary to make a cubic foot when "dry, rodded." With this information the engineer, inspector, or concrete foreman is ready to determine the field proportions or field mix for concrete of the strength specified. Basic proportions may be taken from Bulletin 9, of the Structural Materials Research Laboratory, "Quantities of Materials for Concrete."[2] These basic proportions, in which the volumes of the aggregates are expressed in a dry, rodded condition, are termed the nominal mix. How to transform the nominal mix into the field mix, in which the aggregates are measured damp and loose as found on the job, is illustrated in the following example.

DETERMINING THE PROPORTIONS FOR 3000 POUND PER SQUARE INCH CONCRETE

Suppose the sand on the job is graded from 0 to No. 4, and the coarse aggregate is pebbles graded from No. 4 to 1½ in. With these aggregates it is desired to make 3000 lb. per sq. in. concrete, that is, concrete that will develop that compressive strength at 28 days. The concrete is to be used where a comparatively dry mix may be handled. Concrete with a slump of 3 to 4 in. may be placed without difficulty on most jobs and this slump will be assumed.

The slump is measured by filling a truncated metal cone form with concrete as it leaves the mixer and noting the settlement from the original height when the cone is removed by raising it vertically. The metal cone is 8 in. in diameter at the bottom, 4 in. in diameter at the top, and 12 in. high. In filling the cone, the concrete is rodded into it in three approximately equal layers by prodding each layer 20 to 30 times with a ½-in. bullet pointed rod. Fig. 1 shows how the slump is measured.

Assume the proportions for 3000 lb. concrete with fine aggregate graded from 0 to No. 4, coarse aggregate graded from No. 4 to 1½ in. and a slump of 3 to 4 in. are 1:1.4:2.9. This is the nominal mix, in which the aggregates are measured in a dry, rodded condition. Simple field tests must be made to determine how much fine and coarse aggregates measured damp and loose are required to make a given volume of each in a dry, rodded condition. A cylindrical metal measure, and tamping rod previously described, a scale or balance, and pans in which to dry the aggregates, are all the equipment necessary.

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[1] "The Effect of Moisture in Sands in Proportioning Concrete Mixtures," by R. R. Litehiser, CONCRETE, Vol. 26, No. 1, page 18.

[2] A copy of this bulletin will be supplied free of charge by the Portland Cement Association, 111 West Washington Street, Chicago, Ill.

First, determine the weight of dry sand in a cubic foot of damp, loose sand as used on the job. To do this, fill the measure with a representative sample of sand from the pile in a damp, loose condition, striking off any excess. No tamping is done. Then thoroughly dry the contents of the measure and weigh. Next, determine the weight of 1 cu. ft. of dry, rodded sand. Suppose the field tests gave the following results:

81.4 lbs. = Wt. of dry sand in 1 cu. ft. of sand measured damp and loose.

115.0 lbs. = Wt. of 1 cu. ft. of dry, rodded sand.

Under such conditions it will require $\frac{115.0}{81.4}$ or 1.41 cu. ft. of damp, loose sand, as measured at the mixer, to make 1 cu. ft. of dry, rodded sand.

While coarse aggregate does not increase in volume because of the presence of moisture, there is an appreciable difference between rodded and loose measurement. The amount of damp, loose pebbles needed to make 1 cu. ft. of dry, rodded pebbles may be determined the same way as for sand. Suppose the field tests gave the following weights:

93.0 lbs. = Wt. of 1 cu. ft. of damp, loose pebbles.

106.0 lbs. = Wt. of 1 cu. ft. of dry, rodded pebbles.

Accordingly $\frac{106.0}{93.0}$ or 1.14 cu. ft. of damp, loose pebbles are needed to make 1 cu. ft. of dry, rodded pebbles.

The nominal mix assumed, 1:1.4:2.9, is transformed into the field mix by multiplying the dry, rodded volumes by the factors determined above, 1.41 for sand and 1.14 for pebbles, thus, 1:1.4 x 1.41:2.9 x 1.14 or 1:1.97:3.31. When cement, sand and pebbles are proportioned by volume at the mixer, a 1:1.97:3.31 field mix, using only sufficient water to give a slump of 3 to 4 in., may be expected to give 3000 lb. per sq. in. concrete at 28 days, where the aggregates are graded as specified in this example and contain the same amount of moisture. Other aggregates with different gradings and moisture contents will require different field mixes, each of which can be determined as above.

Proportioning By Weight

Measurement of concrete materials by weight at once eliminates the bulking effect of moisture and loose measurement. If the materials were perfectly dry, measurement by weight would insure the same quantities of materials in each batch. The only error, therefore, results from the weight of moisture contained in the aggregate and weighed as being aggregate.

Sand is almost never dry on a job. Ordinarily the variation of moisture ranges from 2% to 8% with an average of about 4% by weight of the sand. The moisture in coarse aggregate will average about 2%.

Determining the Proportions by Weight for 2500 Lb. per Sq. In. Concrete

Suppose this time it is desired to obatin 2500 lb. per sq. in. concrete, using the same aggregates and slump as before. The nominal mix (from tables) for a fine aggregate graded from 0 to No. 4, a coarse aggregate graded from No. 4 to 1½ in. and a 3 to 4 in. slump, is 1:1.8:3.5.

To transform the nominal mix (aggregates measured in a dry, rodded condition) to the field mix by weight, simple field tests, similar to those where proportions by volume are used, may be made. Suppose the following results were obtained from the field tests:

85.5 lbs. = Wt. of 1 cu. ft. of damp, loose sand.

81.4 lbs. = Wt. of dry sand in 1 cu. ft. of damp, loose sand

4.1 lbs. = Wt. of water in above sand.

93.0 lbs. = Wt. of 1 cu. ft. of damp, loose pebbles.

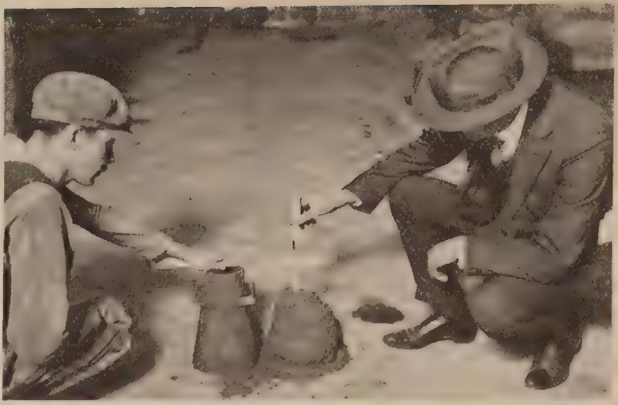

Fig. 1—Measuring a 4-in. slump test

91.2 lbs. = Wt. of dry pebbles in 1 cu. ft. of damp, loose pebbles.

1.8 lbs. = Wt. of water in above pebbles.

115.0 lbs. = Wt. of 1 cu. ft. dry, rodded sand.

106.0 lbs. = Wt. of 1 cu. ft. dry, rodded pebbles.

The nominal mix by volume, 1:1.8:3.5 is first transformed into the nominal mix by weight by multiplying each of the above unit volumes by their weight per cu. ft. (aggregates dry rodded):

1 x 94:1.8 x 115.0:3.5 x 106.0 = 94:207:371.

Dividing by 94 to put the mix in the customary form we get: 1:2.20:3.95.

From the field tests the percent of moisture in each aggregate is determined as follows:

$\frac{4.1}{8.41}$ x 100 = 5% moisture in the sand.

$\frac{1.8}{91.2}$ x 100 = 2% moisture in the pebbles.

The nominal mix by weight may now be transformed into the field mix by weight by multiplying the weight of the sand and pebbles by 1.05 and 1.02 respectively to compensate for the moisture present:

1:2.20 x 1.05:3.95 x 1.02 = 1:2.31:4.03.

The preceding computations merely provide for the weights of sand and pebbles when damp, that are necessary to give the required weights of dry sand and dry pebbles.

When cement, sand and pebbles (the aggregates of the grading and moisture content specified in this example) are proportioned by weight, thus, 1:2.31:4.03, and just sufficient mixing water is used to give a 3 to 4 in. slump, the resulting concrete may be expected to develop a compressive strength of 2500 lbs. per sq. in. at 28 days.

Inundation Method

When sand, regardless of its initial moisture content, is poured or shoveled into a measure containing sufficient water to flood or inundate it, the bulking due to its original moisture content is ironed out. That is, the amount of dry sand in a given volume of inundated sand is practically the same. This characteristic of sands has been recognized for several years and has been employed in developing an inundator, or device for measuring the sand for a batch of concrete in an inundated condition. While used as yet only to a limited extent, the method appears to have much promise as it automatically corrects for the bulking of sand due to its moisture content.

Experimentation also points to the fact that there is a definite relation between the standard dry, rodded volume of a given weight of dry sand of a given size and grading, and the inundated volume of the same weight of this sand. This is indicated in the following experiment, the results of which are shown in Fig. 2.

The tall glass jars were originally filled to the top of the white paper strips with the same weight of dry, rodded sand. Coarse sand, graded from 0 to No. 4, was used in the first

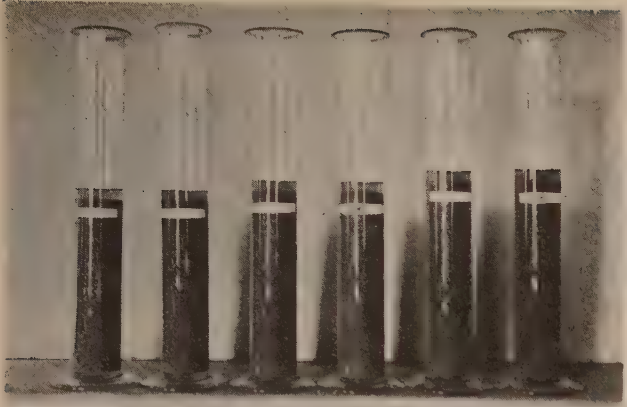

Fig. 2—Experiment showing the volume of a given weight of dry sand in an inundated condition is about 6% greater than in a dry rodded condition

two jars (left to right), medium sand, graded from 0 to No. 8 in the middle two, and fine sand, graded from 0 to No. 48, in the remaining two. After the dry, rodded volume of each sample had been marked by means of the paper strip, the sand was removed. Sufficient water was then placed in each jar to inundate the sand and each sample scooped back into the jar it originally occupied. Fig. 2 shows that practically the same relation exists between the dry, rodded volume and the inundated volume of each grading of sand. Actual measurement shows that for the coarse sand the average inundated volume was about 6% greater than the dry, rodded volume, about 7% greater in case of the medium sand, and about 7½% greater in case of the fine sand. These results are in conformity with more extended tests which indicate that for sands evenly graded from 0 to No. 4, the inundated volume of a given weight of dry sand is about 6% greater than its dry, rodded volume. Where the inundation method of measuring sand is used in proportioning concrete for a specified strength, this relation should be determined for the sand on the job.

DETERMINING THE PROPORTION FOR 3500 LB. PER SQ. IN. CONCRETE

Suppose an inundator is to be used on a job where 3500 lb. per sq. in. concrete is required, using the same aggregates and slump as in the two preceding examples. From tables of dry, rodded materials, the nominal mix is found to be 1:1.0:2.4.

Field tests must now be made to determine how much sand in an inundated condition is necessary to make a cubic foot in a dry, rodded condition, and also how much loose, damp pebbles is required to make a cubic foot when dry and rodded. Suppose the tests gave the following results:

115.0 lbs. = Wt. of 1 cu. ft. of dry, rodded sand.
108.5 lbs. = Wt. of dry sand in 1 cu. ft. when inundated.

It will be apparent that, if the cubic foot of dry, rodded sand, whose weight was determined. is next inundated, it is not all required to fill the measure. If the remainder is weighed and subtracted from the original weight, the difference will be the weight of *dry* sand in a cubic foot when inundated.

From the above weights it is seen that $\frac{115.0}{108.5}$ or 1.06 cu. ft. of sand when inundated are required to make 1 cu. ft. in a dry, rodded condition. As the same pebble aggregate is to be used in this example as before, the result of the previous tests may be used here. These show that 1.14 cu. ft. of damp, loose pebbles are required to make 1 cu. ft. of dry, rodded pebbles. The nominal mix, 1:1.0:2.4, may now be transformed into the field mix as follows:

1:1.0 x 1.06:2.4 x 1.14 = 1:1.06:2.74.

The above proportions, using just sufficient water to give a 3 to 4 in. slump, should give 3500 lb. concrete at 28 days, where the above sand is measured in an inundator and the pebbles by volume, damp and loose.

Where this method is used, in supplying the water for the mix, proper allowance must be made for the large quantity used in inundating the sand. The water used in inundation is part of the mixing water.

CONCLUSION

In the preceding paragraphs an attempt has been made to show how to make corrections in the proportions for a concrete mix to produce a specified strength. Obviously tables intending to give proportions for a specified strength must be based on constant conditions of measurement, and these proportions must then be corrected for field conditions in such a way as to obtain the basic quantities in the tables.

The tables from which the basic proportions used in the examples were taken are for good average conditions in which aggregates are well graded, and only thoroughly workable consistencies used. Whenever the aggregates are poorly graded or unusually harsh consistencies are used, test cylinders should be taken in order to check the proportions. In any case, however, it will always be necessary to make corrections for bulking due to moisture and loose measurement.

A New England Street of Concrete Homes

The fire which destroyed so much in Salem, Mass., in 1914, turned many a builder's thoughts to masonry. The picture, made recently of a group of eight two-family houses, built in 1915, which comprise all the homes on a short street in Salem, known as Orne Square. The houses in this section had been entirely destroyed the year before, and when it came time to rebuild, the owner, Alfred W. Putnam, a Boston attorney, chose concrete masonry, stuccoed.

Work was started in October, 1915, on the foundation for the first house, and by February of the next year all the houses were completed and some of them occupied. The walls were furred on the interior for the application of plaster, but the stucco coats were applied directly to the exterior. The appearance of the rather plain type of architecture was very effectively enhanced by the arched and recessed entrances.

Mr. Putnam states that they are easily heated, that tenants have always been satisfied, and that he has never heard any criticism. He further expresses the opinion that the block and stucco house is a very economical and desirable type of construction. The good favor in which these houses are held locally is demonstrated by the fact that Mr. Putnam has to keep a waiting list of would-be tenants.

The architect, Ambrose Walker, 9 Cornhill, Boston, and also a resident of Salem, furnishes the surprising information that many of the tenants of the Orne Square houses are families who might easily be expected to occupy far more pretentious homes, and draws the inference that their choice does not reflect upon their judgment.

Kent System of House Construction

The Kent system, which was first patented in England in 1919, is one of the concrete slab systems in which there are two separate and distinct skins to the wall with a large air space between, continuous both vertically and horizontally. The only places where the two skins are connected are at the corners of the slabs, where they are bridged by damp-proof blocks. Condensation on the inner surface of the walls is obviated by making the inner skin of the wall of "breeze" or similar concrete into which nails can be driven.

The first house built on this system was erected in England in 1920 at a reported cost about two-thirds of the usual cost of a similar house. In Belgium, a house was erected in 1923 for an amount less than the cost of a brick house of the same size, with brick costing $24.00 per thousand. The system has been tried out in the United States, a house having been built in North Carolina, in 1923, for $2,600, as compared with a timber house of the same size costing $2250. The patent right for the United States, covering the construction of hollow walls as granted to Colonel H. Vaughan Kent, London, England, has been acquired by The Kent Co., of America, Inc., Philadelphia, Pa.

Among the advantages attributed to the system is the fact that, from the builders' point of view, the system permits the building of many different styles and sizes of houses with the same unit and with very cheap molds. The system makes subsequent alterations easy, while the elimination of mason labor makes it attractive to those whose work has previously been confined to the usual lumber construction.

The system of construction is that generally known as the pier and panel type. The roof and upper floors are entirely carried by the pillars, while the bays between these are filled in with non-bearing slabs or sheets of suitable material. The fact that there is no direct connection between the outer and inner surfaces insures insulating value and the stopping of the passage of moisture. Windows have concrete frames and sills, and no scaffolding is required in the construction. All studding and weather boarding are replaced with the concrete uprights and concrete slabs.

This eliminates all wood from the foundation to the cornice, with the exception of the wooden windows and sashes. With roofs of proper materials, a saving should be effected in insurance and the fire hazard very materially reduced.

In the construction, the outer wall units are held in place by the same bolts which secure the inner walls, these bolts being precast in the pillars. The load on the bolts is only that exerted by the tendency of the wall slabs to topple over inward. The slabs are sufficiently strong to carry their own weight. Grooves cast in the top and bottom edges of the outer slabs are filled with a cement grout at the time of erection and provide an efficient wind and water stop between the slabs. No jointing is necessary along the butts between the slabs and pillars.

The inner slab may be of ordinary concrete, cinder concrete, or one of the various nailing concretes, with plaster or paper covering, or in the very cheapest class of dwelling may be left bare with a rough pointing along the joints. In any case the nuts are countersunk into these slabs, so

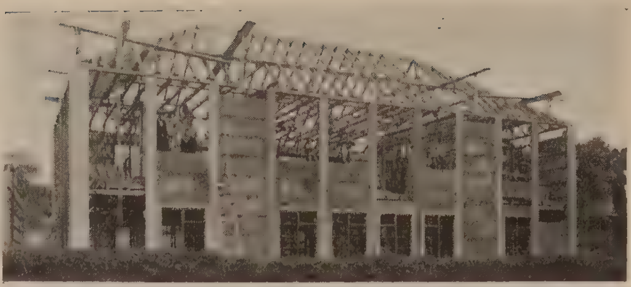

Fig. 3—One of a number of Kent houses being erected at Marlow, England, as the construction appeared at 10 A. M.

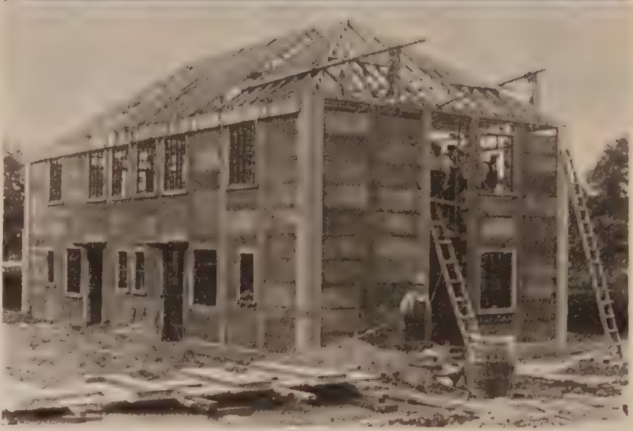

Fig. 4—The same house, as it appeared at 1:30 P. M. the same day

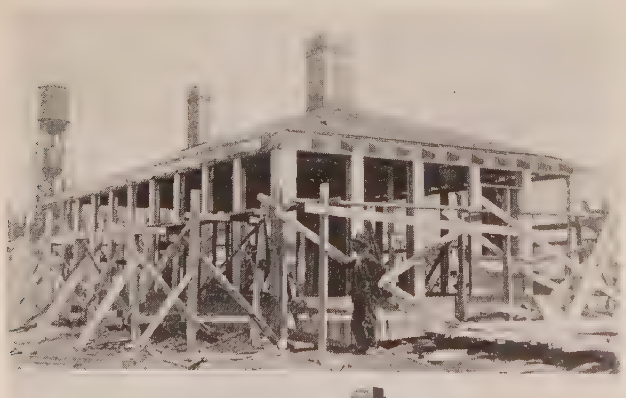

Fig. 1—Six-room southern mill cottage under construction, using the Kent system, showing fire-stop at roof line

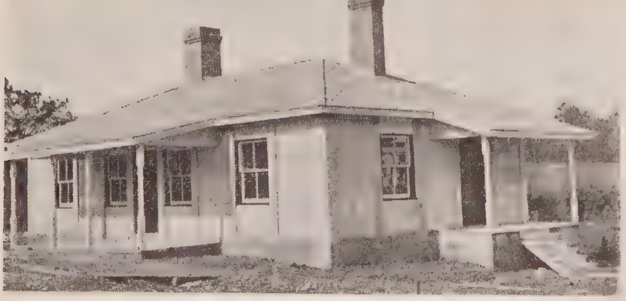

Fig. 2—The completed cottage

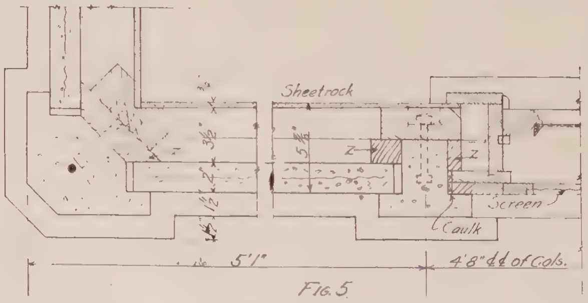

Fig. 5—Section, showing assembly of wall

Pieces marked "z" act both as wedge or chock pieces and wind stops. They may be cut to allow assembling of slabs, but they must be continuous from sub-floor to wall plates as to provide a flush inner surface. A very satisfactory inner wall can also be obtained by making the inner slabs from sheetrock or similar wall board, backed by wood or metal lath framing. This method may be adopted owing to the extensive distribution of such materials, their easy use, and in the case of sheetrock, the fact that this material when used for inner slabs, partitions, and ceilings, provides an absolutely fireproof house at about the same cost as wood sheathing.

Foundation work for Kent walls is confined to providing proper footings for the pillars, which, for the small type of dwelling under consideration, may be spaced anywhere from 4 to 5 ft. apart. If a curtain wall is added between these footings, the first floor may be of concrete on a cinder fill, or a basement may be provided. Where the usual wood floor is to be fitted, the joists are carried on wood or steel sills bolted onto the pillars, this sill also forming a base to carry the wall slabs. The precast columns for a two-story house can be easily upended and fastened in place by grouting to the footings.

In connection with the maintenance costs of Kent houses, it is cited that by the use of white cement for the pillars and outside concrete slabs, a permanently white house can be obtained, which will never require any outside painting other than the little required for the wood trim of windows and doors. If the line of joining between slabs is objected to as too new a feature in the appearance of the whole outside of the house, spaces between pillars can be covered with stucco.

Corbels are cast on the columns to carry the floor joists and the roof trusses, and the latter can be secured to the columns by nuts on the reinforcement rods projecting from the tops of the columns. The lower ends of the reinforcement rods will be left projecting into pockets left in the plinth, so as to anchor the columns to the foundations.

No special machinery is required for a system of this sort, for timber molds for columns and slabs can be made easily by the carpenter, care being taken to make them all alike, and to space the bolts accurately in the columns, and to see that the beds for the latter are all at the same level. The columns must be spaced absolutely at the right intervals, but there is no difficulty in these operations, which can be carried out by a semi-skilled man.

Only a short interval need elapse between the completion of the job and the occupation of the house where precast concrete units are used.

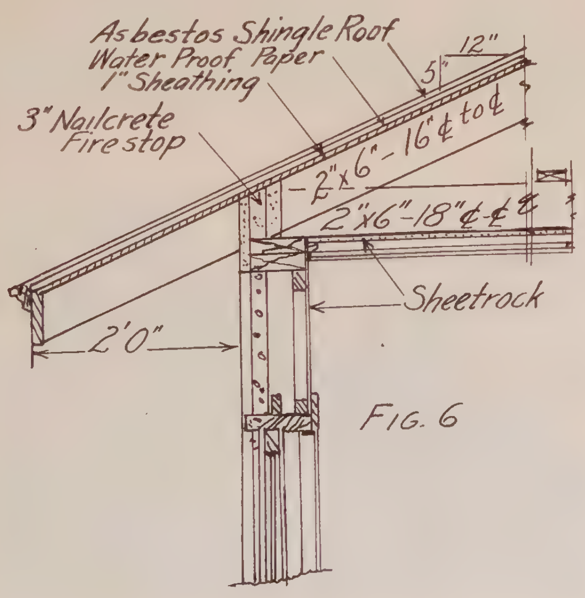

Fig. 6—Part section, showing details of fire-stop and roof framing

A window in its frame, which can be made of concrete, is generally 4 ft. 6 in. high by 4 ft. wide, out to out, taking the place of 3 ordinary slabs. Similarly, a door frame takes the place of 5 slabs, being 7 ft. 6 in. high by 4 ft. wide, out to out.

The most convenient dimensions for the internal slabs are 4 ft. 6 in. long, 18 in. high, and 2 in. thick, with a 3-in. rib, 1 in. thick, along the inner side of the top and bottom edges of the slab. These ribs, besides strengthening the slabs considerably, facilitate their handling and the lifting of them by tackles into their positions. In small jobs, the lifting tackle can be swung from a tripod of scaffold poles, high enough to overtop the walls, and the same tackle can be used to up-end the columns from the ground and set them in the pockets left in the plinth course, where they will be stayed in a vertical position and grouted in.

Air Space as Insulator

That the heat required for maintaining a constant temperature in a room with the hollow wall type of concrete construction is 15 to 30% less than for solid concrete was determined by experiments conducted by engineering students in the Materials Laboratory, Oregon State Agricultural College, Corvallis, Ore.

From the temperature gradients, it is shown that the dead air space has approximately the same thermal conductivity as has the concrete itself. From the sample computations, it is also evident that the hollow wall type of concrete construction is superior to the single or solid wall type when used as a heat insulator. The smaller amount of heat required for the hollow wall type of construction represents a saving of fuel in the same proportion varying somewhat with the temperature conditions.

Experiments were conducted to determine the thermal advantage of concrete walls having a dead air space, in accordance with the system invented in 1919 by John Taylor, Forest Grove, Oregon, this new type of construction being accomplished by means of small movable molds instead of the usual form work. The immediate object of the series of tests was the determination of the thermal conductivity constant for hollow and solid concrete walls.

A product of this type of construction consists essentially of a double wall of concrete tied together by metal ties. No concrete extends through the wall, and the air space extends entirely around the building and from footings to the plate and rafters. The air space may be made to form a dead air space, or it may be constructed to allow for ventilation of the building. The walls can be built of any desired width. Special advantages claimed for the process are the simple method of construction and comparative inexpensiveness. All of the form materials are of common stock lumber, which can be used in the construction of the building after the walls are up. The forms are simple and move up as the walls are constructed, hence the material and labor are reduced to a minimum. Four men have set the forms and built the walls of the average seven-room house in from four to five days.

Some of the main points advanced against the building brick and hollow tile on the market today are high cost and a certain amount of seepage through the walls, which may cause destruction of plaster and consequent damage. It was due to the effort to develop a type of construction having as many of the advantages and as few of the disadvantages as possible that the thermal wall type was perfected.

It is claimed that from actual experience in the construction of this type of wall, it has been found possible to compete with wood frame, double construction. When compared to brick and tile construction, there is a considerable margin shown in favor of the hollow concrete. Not only the material itself costs less but the cost of labor required to put up a structure of this type is much less. With the hollow concrete method, very little experience is required, and common labor may be employed to do most of the work.

In the building process, an outside and inside series of flat rectilinear boards or plates, extending around all of the walls of the building under construction, are employed. An intermediate series of plates, comprising respectively a pair of wedge sections and an upright framework for supporting them, is also used. Grounds are necessary where finish is to be nailed to the concrete wall, either interior or exterior. The process is carried on for any number of stories desired.

The joists are rested on the inner wall, the rough flooring laid, and the concrete poured around the joist in such a manner as to embed it in solid concrete in the inner wall, or a space may be provided for the joist by means of removable joist blocks, which can be set in the concrete and later removed when the joists are ready to be placed. By use of the joist blocks, an air space may be provided around the joist. Each floor level comprises one unit of the thermal wall, the dead air space being sealed over with a layer of concrete at the same level as the joists.

One particularly interesting feature, noted in the experiment above referred to, was the time required for the temperature to become constant when changing from run No. 1 to runs No. 2 and 3. Approximately 2 and 3 days' time was required for the temperature to drop 40°. This would mean that the temperature in a building could be kept practically constant with very little trouble, and that the drop in temperature after the heat was turned off would be correspondingly small as compared with the solid wall type of construction.

British Concrete Cottages

Abstracted from *Concrete and Constructional Engineering.*

The feature of a novel system of concrete wall construction known as the R. C. C. system, patented by the Rogers Construction Co. Ltd., St. James, England is the reinforcement which takes the form of flat sheets of steel from 26 to 30 gage, so stamped as to form wings projecting from each face of the sheet. The four triangular pieces in each of the separate stampings in the steel sheet are bent two outward and two inward, to form tangs or wings projecting from each face of the sheet. Two of these sheets are placed face to face and fastened together by clips locking the tangs on each sheet where they come into juxtaposition.

The reinforcement serves two purposes, (1) to impart tensile strength to the wall and (2) to make it possible to release the forms soon after pouring because of the support given to the concrete by the tangs embedded in it.

In erecting the walls, the footings are first laid and a longitudinal groove provided in order to give a bond to the wall. Timber uprights are then placed at about 10-ft. intervals around the building to allow raising the form sections by hand.

The verticals are braced and serve as joists for the forms. Uprights or form guides are erected on both sides of the wall. Those on the outside being built the full height of the wall and those on the inside, if the building is to be of more than one story, being erected only to a height of the first story. With the footings and uprights or form guides in place, the form sections are placed for the first pour. A steel face is used on the timber forms to facilitate the upward movement of the forms and to obtain a good surface finish to the concrete. On each side of the uprights is a steel angle throughout its entire length and against these angles the form sections are placed. These angles prevent the forms from being forced outward by the pressure of the concrete. The top of the sections which are built 15 in. high are provided with sloping boards which guide the concrete down between them. Sheets of reinforcement are placed in position in the middle of the forms and concrete placed from each side simultaneously and tamped into the space between the two locked sheets of steel. The sheets are erected alternately with one standing on end, 6 ft. high x 2 ft. wide and three superimposed, one above the other on edge, filling an area 6 ft. x 6 ft.

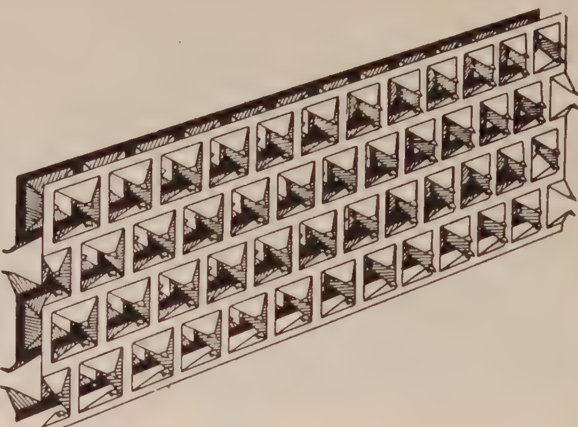

Fig. 1—R. C. C. reinforcement made from stamped steel sheets

As soon as the one section of wall is placed, the forms are lifted for a new course. The concrete is thus left unsupported soon after it is laid and the possibility of rapidly releasing the forms without waiting for the concrete to set is claimed to be one of the chief advantages for the system. The speedy removal of the formwork also makes it an easy matter to brush off the surface film of concrete and expose the aggregate.

The reinforcement being in the form of perforated sheets, practically divides the wall into two leaves. A wall can be formed with weatherproof gravel concrete on the outside and a breeze or cinder concrete on the inside to avoid condensation. As the two parts are placed simultaneously and to a certain extent intermingled, a good bond is obtained.

It is claimed for the system that it obviates the necessity of searching for any skilled labor for the erection of the shell of a house and that about 25% of the cost of a house as compared with brickwork can be saved by the substitution of the concrete.

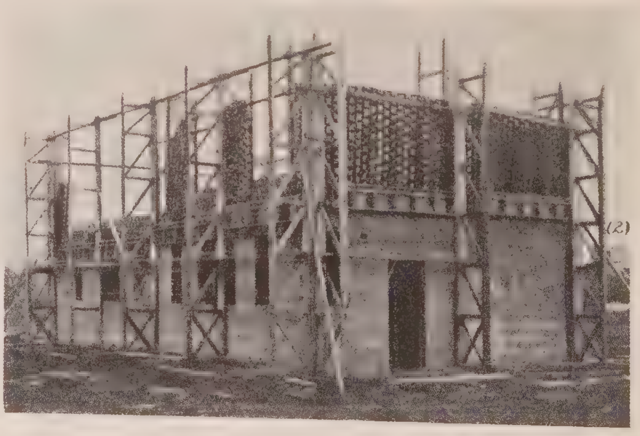

Fig. 2—House under construction showing reinforcement in place and forms and guides ready for concreting

Some Notes on Uses and Characteristics of American Alumina Cement

American made alumina cement has been on the market less than a year.[1] *It has been applied to many different problems—bridge floors and concrete pavement intersections, and patches where interruption of traffic has heretofore been a serious inconvenience; experimentally in the manufacture of concrete roof tile; factory floor patches and in many minor jobs connected with industrial plants where work done Saturday afternoon would be ready for normal factory use by Monday morning; to stop leaks into mines; machinery foundations.*

While CONCRETE *has published a good deal about the characteristics of similar cement made and used abroad, it is interesting to present a summary of observations and conclusions based chiefly on the test and use of the American product. This outline is written for* CONCRETE *as a tentative statement only but it is published as a basis of its further use and of further tests.*

Atlas Lumnite cement is a hydraulic cement. The method of using it in construction work is essentially the same as that of portland cement. There are differences in the composition and use which account for the very great differences in the results obtained.

Portland cements are a mixture of argillaceous and calcareous materials which have been intimately mixed, burned and the resultant clinker ground to an impalpable flour, to which gypsum is generally added to regulate the setting time.

Alumina cements are a mixture of aluminous and calcareous materials which have been intimately mixed, heated to fusion and the resultant mixture ground to an impalpable flour.

The hardening or hydration of the two cements are essentially different because of the differences in chemical composition. The predominating compounds in portland cements are the calcium silicates with a smaller percentage of calcium aluminates. The predominating compounds in alumina cements are calcium aluminates with very small amounts of calcium silicates.

It is the small quantities of calcium aluminates in portland cements that are responsible for such early strength as it develops. The slower hydration of the calcium silicates give to the portland cement its later day strength and the increase in strength of the 28-day and later periods over the strength at 24 hrs.

The rapid hardening properties and the high initial strength of Lumnite cement are due to the presence of the greater amount of calcium aluminates, developing at 24 hrs. a strength considerably greater than that of portland cement at 28 days.

In general, Lumnite cement is used in the same way as is portland cement. To make concrete, it is mixed with sand and gravel or other aggregates and water. It depends upon the mixing water for its activity. An excessive amount of mixing water will result in lower strength due to the excessive hydration of the cement, or what is popularly termed "the drowning of the cement." In these respects Lumnite cement does not differ from portland cement.

Lumnite cement is slow *setting*, obtaining its initial set at about the same time as does the average normal portland cement. This allows ample time for mixing, transporting and placing into forms. Portland cement however appears to begin to stiffen almost at once and the process of hardening proceeds rather gradually. On the other hand Lumnite cement appears to remain in its original plastic state for a longer period and then when the process of hardening begins this process proceeds much more rapidly.

Portland cement apparently hardens from the outside in, while on the other hand Lumnite cement appears to harden from the inside out. Frequently the surface of Lumnite cement is quite soft while the interior of the mass has attained appreciable strength. This fact has made it difficult to determine the time of set of Lumnite cement, especially the final set, with the apparatus now used for determining the time of set of portland cements.

Under average conditions Lumnite cement concrete is sufficiently hard at the end of 5 or 6 hrs. to permit the application of water to the surface, without danger of washing away the cement.

After Lumnite cement has obtained its initial set it hydrates with considerable rapidity so that at the end of twelve hours it has developed appreciable strength. This rapid hydration is accompanied by an increase in temperature of the concrete due to the rapid chemical action. In large masses of concrete or in very rich mixtures, the rise in temperature is much greater and much more rapid than for leaner mixtures or in smaller masses.

Apparently the temperature remains approximately constant for the first two or three hours. Then it begins to rise rather slowly at first, with increasing rapidity until sometime between the sixth and twelfth hours maximum temperature is reached, after which the temperature decreases rapidly.

It is during this early period of hydration as indicated by the rise in temperature that water should be applied to all exposed surfaces of the concrete. It is explained that this water is necessary to replace the water that has been evaporated and to supply water to the surface to replace the water that has been absorbed into the interior of the mass during hydration.

Unfortunately this period of maximum temperature generally occurs at night, from eight to twelve hours after the concrete has been mixed, when, usually, no one is present to keep exposed surfaces moist and provide for the dissipation of the heat. This fact undoubtedly explains some of the irregularities found in results obtained in testing Lumnite cement. The test specimens are placed in a moist closet, frequently a small compartment made of non-conductive material with no provision for ventilation. The result is that it becomes in fact, a fireless cooker producing not only excessive heat but a drying condition rather than a moist condition.

The use of heat as an accelerator is unnecessary and inadvisable. Concrete blocks from the same batch were divided—half were stored out of doors. The other half were stored in a steam curing room, such as is commonly employed in making concrete blocks. Those blocks that were stored out of doors developed in 24 hours a strength almost double those cured in the steam curing room.

Much emphasis is given to the importance of the proper curing of Lumnite cement concrete. This is rightfully so when it is remembered that in a few hours time, Lumnite cement develops as much strength as portland cement develops in several weeks. Lumnite, in general, requires less attention, but this attention is more important for a short period of time.

The French manufacturers state that alumina cements are twice as efficient as portland cement. In other words, engineers are using either double the load or half the amount of concrete.

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[1] Atlas Lumnite Cement Co., 25 Broadway, N. Y. C.

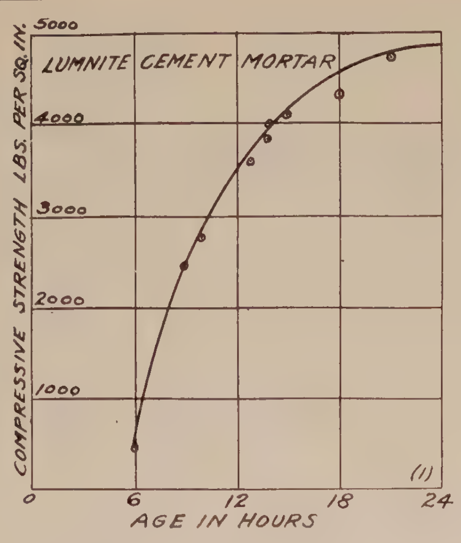


Fig. 1—Compression test, 2x4 cylinder 1 lumnite, 3 Ottawa sand, Pittsburgh Testing Laboratory

It should be stated that this practice has not been universally accepted in France. However the indications are that with alumina cements considerably greater loads can be carried or leaner mixtures employed.

Investigations abroad and in this country have indicated that the modulus of elasticity of alumina cements is about double that of portland cement. The modulus of rupture appears to be double that of portland cement. The strength of the bond of alumina cements to reinforcing steel is apparently double that of portland cement. These and other test results apparently substantiate the arguments of the French engineers.

Both the French manufacturers and the American inventor of Lumnite cement claim that much greater density is obtained with alumina cements than with portland cements. Various reasons have been advanced to explain this property. Observations of the actual use of Lumnite cement tend to substantiate these claims.

Lumnite cement bonds to old portland concrete at least as well as one portland cement concrete bonds to another. The usual precautions should be taken—to roughen the surface and remove the skin coat, which must also be done when new portland cement is bonded to old portland cement concrete.

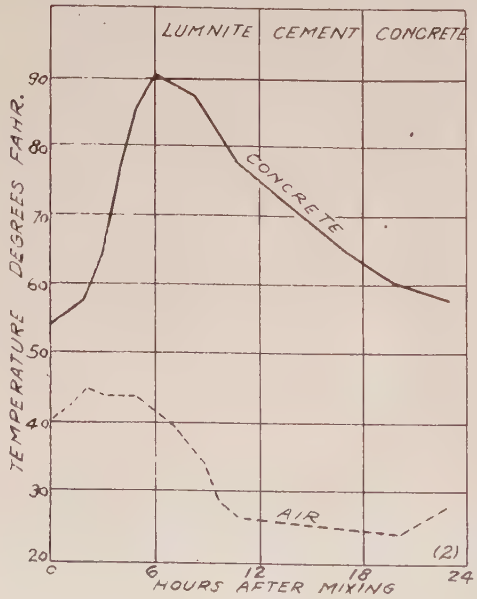


Fig. 2—Temperature record, Tiverton-Fall River road, Rhode Island Board of Public Roads

Investigations and tests both in this country and abroad show that alumina cements can be used at much lower temperature without danger from the action of frost than can portland cements. These results have been substantiated by the actual use of alumina cements in construction work at low temperatures. There are two reasons why alumina cements can be used successfully in much colder weather: First, due to its rapid hardening qualities it reaches in a few hours a point in its curing beyond the danger of frost attack; Second, this rapid hardening, a chemical action, produces in Lumnite cement concrete very considerable heat. The accompanying charts illustrate the two foregoing statements.

Fig. 1 is a curve plotted from a series of compression tests made by the Pittsburgh Testing Laboratory on some 2 x 4-in. cylinders of a standard 1:3 mortar, and shows the rate of hardening as indicated by the compressive strength from the sixth to the 24th hr.

Fig. 2 gives two curves plotted from temperature readings obtained by D. A. Soule, of the Rhode Island State Board of Public Roads. One curve shows the temperature of the air. The other curve records temperatures developed in a Lumnite cement concrete slab during the period of hardening. The temperature of the concrete was taken with a thermometer through a hole in the surface of the concrete, 4 in. deep. These illustrate what happens in a thin section of Lumnite cement concrete under normal conditions.

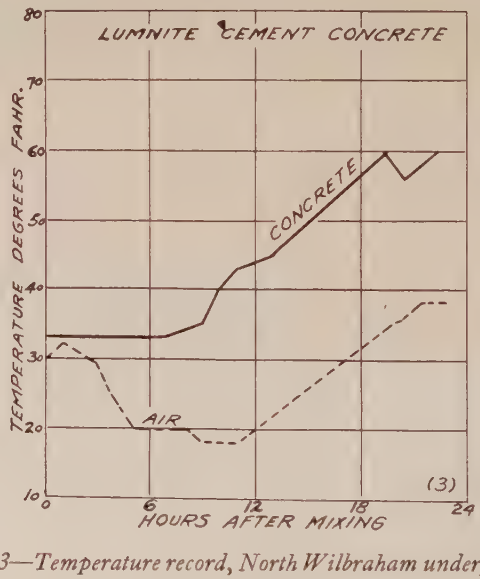


Fig. 3—Temperature record, North Wilbraham underpass, Massachusetts Public Works Highways

Recently some tests were made at Columbia University to determine the effect of low temperature on the compressive strength of Lumnite cement concrete. 6 x 11-in. cylinders were made of chilled materials and iced water in the proportions of one part Lumnite, two parts sand and four parts gravel. The cylinders were placed immediately in a freezer at about 25° F. and kept there for 28 days. They were then removed, brought to room temperature, and tested in compression developing a strength of approximately 3300 lbs. per sq. in.

Last winter (1923-24) a section of a 12-in. concrete wall was constructed. One half was 1:2 Lumnite cement concrete and the other half a 1:2:4 portland cement concrete. The temperature of the mixing water was 34° F. and the temperature of both concretes when placed in the forms was 38° F. At no time did the temperature of the air go above 40° F. and during the night it fell to 32° F. Five hours after the Lumnite cement concrete was mixed, it had set. The portland cement concrete did not harden until considerably later, and at the end of 24 hours it had very little strength.

Recently, temperature records were made of Lumnite cement concrete during the first 24 hrs. after mixing, on some work done for the Massachusetts State Bureau of Highways. The temperatures obtained are shown in Figs. 3 and 4.

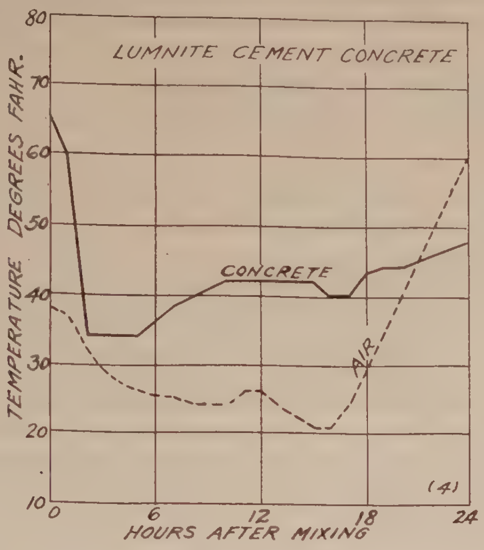


Fig. 4—Temperature record, North Wilbraham underpass, Massachusetts Public Works Highways

In Fig. 3 it will be noticed that cold materials were used, and that the concrete was not heated before being placed. The temperatures of the concrete were taken by placing a thermometer face down on the surface of the concrete. The concrete was covered with a piece of canvas immediately after pouring. These temperature records were made on a small section of concrete, a curve inlet 7 in. thick at the top, approximately 10 in. thick at the bottom, and 4 ft. long. This is a very severe test, because in such a small mass of concrete, the heat is rapidly dissipated.

The concrete represented by Fig. 4 was an 8-in. road slab. Both the sand and gravel used in making this concrete contained frozen lumps, and in order to thaw them out a Hauck burner was used in the mixer. The temperature of the concrete when placed was 65° F.

In Europe, alumina cements have been very successfully used in winter construction, and have elicited much favorable comment, because of their advantages in cold weather work. T. J. Gueritte, in an article on "Aluminous Cement" in the *Structural Engineer*, May 1924, states that "if concrete is mixed with the materials at a temperature above 32° F. and the temperature does not fall below 32° before the initial set takes place, that is to say not before four or five hours, the heat given off after the initial set takes place will raise the temperature and permit the hardening to go on normally, even in severe frosty weather. If, on the other hand, the concrete is so cold, or the temperature is so low, as to cause the water to freeze before the initial set, the setting will be retarded.

M. Gueritte in the same article continues as follows: "Recent tests carried out by Mr. Weaser show that cubes made at 1:45 p. m., the temperature being within 26° F. and kept in the open, had an average resistance to crushing of 4370 lbs. per sq. in. after 12 days. Comparison with Mr. Weaser's tests made under normal conditions show that concrete made under such severe conditions increases in strength more slowly, but the strength remains still so good, that for practical purposes, if the materials are above 32° F., frost is immaterial.

These examples substantiate the conclusions stated in the opening paragraphs about Lumnite cement, namely, that it can be used in much colder weather than can portland cement because:

First, due to its rapid hardening qualities, it reaches in a few hours a point in its curing beyond the danger of frost attack.

Second, this rapid hardening, a chemical action, produces in Lumnite cement concrete very considerable heat.

It is true that other building cements are successfully used in cold weather construction. Sometimes anti-freezing compounds or accelerators are used, or else very expensive precautions must be taken to keep the temperature of the concrete above freezing during the period of hardening. Even so, the advantages normally obtained with Lumnite cement concrete are not possible with these cements; that is, they will not develop in 28 days time, a strength equal to that developed by Lumnite cement at 24 hrs.

It is recommended that the following precautions be observed in using Lumnite cement in cold weather:

1. The material to be free from frost and as near normal temperature (50° F. to 70° F.) as possible.
2. Lumnite develops its strength in 24 hrs. and at low temperatures requires protection during that period. In moderately cold weather, the concrete should be protected from cold winds during the first few hours. In other words, give the cement a chance to get started.
3. Do not use anti-freezing compounds until their effect on the strength of Lumnite cement is known.

Compression Test Results Obtained by Columbia University on Lumnite Cement Concrete Block

Series	No. 1	No. 2	No. 3	No. 4	No. 5
Mix	1 Portland 3 Sand 3 Slag	1 Lumnite 3 Sand 3 Slag	1 Lumnite 3 Sand 3 Slag	1 Lumnite 4½ Sand 4½ Slag	1 Lumnite 6 Sand 6 Slag
Block Per BBl. Cement	60	60	60	90	120
Method of Curing	Steam Room over night then out of doors until tested.	Ditto Series No. 1	Out of doors as soon as made and until tested.	Ditto Series No. 3	Ditto Series No. 3
1 Day	230 195 210	925 1000 990	1600 1640 1550	1230 810 810	445 435 485
Average	212	972	1597	950	455
2 Days	300 315 345	575 690 1040	1790 1850 1850	1390 1400 1090	670 595 585
Average	320	768	1830	1293	617
7 Days	615 630 665	950 1070 1520	1930 1750 1900	1020 1420 1300	865 800 725
Average	637	1180	1860	1250	797
28 Days	900 875 900	1010 1240 1200	2100 2110 2210	1410 1560 1716	635 885 905
Average	892	1150	2140	1577	808

Concrete in Repair of Frame Building

The use of concrete in the repair of a gas engine plant in Hastings, W. Va., is described in a letter from W. J. G. Taylor who was in charge of the work. The job which saved some money and prolonged the life of a 20-year old wooden building for several years included replacing the old sills and renewing posts in the plant. The wooden sills which had become badly decayed were replaced by concrete sills 6 in. x 24 in. in section. Posts were cut off 18 in. above the floor or to a point where they were solid and concrete piers were built under them so that the ends of the wooden members were raised above any possible moisture which might accumulate on the concrete floors.

The Actual Experience of a Manufacturer Who Added Brains to His Mix

How to Make 100% Better Products With 20% Less Cement

Fine aggregate is the biggest single drawback in the products business. W. B. Trost, Waterloo Concrete Corporation, Waterloo, Iowa, making the staves for and building 100 silos a year has learned this.

By "adding brains to the mix" he has increased his output of staves per sack of cement by 25%; increased the strength of his product 100%; reduced the absorption 50% and cut the breakage from 3% to 1%.

Against this has to be charged additional plant investment of only $1,000 for the equipment to handle aggregates so as to use a mix with a higher fineness modulus.

The company's line of business is the manufacturing and building of concrete stave silos. From 1917 to 1921 there was about a 50% increase in sales every year until the fatal year of 1921 when it dropped down to only about 30 jobs for the entire year. Since that year there has been a very substantial gain each year until in 1924 business was about on a par with the year 1918.

He had always been able to buy just one grading of sand, that is, ¼ in. and down, either from the river which was fairly clean or from a pit. This aggregate had a fineness modulus of 2.00 to 2.40. The material was left over after the coarse stuff had been screened out, and it could be delivered at the mixer for about $1.50 a yard. It made a very smooth stave. Many a products man has gone wrong on that quality of smoothness—imagining that the smoothness meant strength, density and waterproofness. A fine grade material like that would take very little water in mixing beyond a certain minimum. A little more water and the staves would sag and of course the mixer man would dry up the mix again. When Mr. Trost saw the light—the additional strength and economy in a coarser grading he took up the matter with the dredging company and in the spring of 1924 found that he would be able to buy the material from the river just as pumped out and washed for the same price as the sand. It would however contain some material up to 1 in. This of course was too large for a thin product—2½-in. in a tamped product. Mr. Trost bought a set of screens and found that he should have and could use material up to ⅜ in. or passing through a ½-in. screen. After making a test of it for workability in his staves he found that it was about the largest aggregate that could be used successfully. This brought the issue down to getting a method of handling two different kinds of materials. It was decided to install two circular concrete stave bins 10 ft. diameter by 25 ft. high with an opening at the bottom of each bin near the mixer or just room enough for a man to use a shovel from either bin and also put in regular silo door frames 12½ and 15 ft. from the top of the mixer with the idea that the material might be spouted into a measuring or weighing hopper to be placed above the Blystone mixer. So far there has been no time since last spring to install the weigher or spouts but they will be put in this winter during slack time, arranging it so that material can be drawn from either bin in any desired quantity and dumped into the mixer.

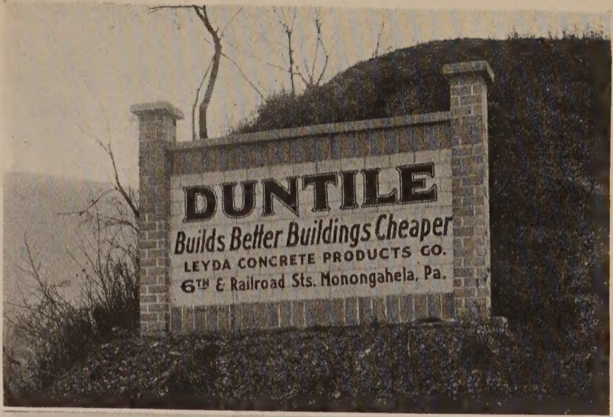
As conditions are such here that material can be delivered at the plant by truck as cheaply as it can be shipped in, the dump was not placed on the railroad siding. A pit was dug about 5 ft. into the ground and a concrete wall put in all around it and into this was set a Caldwell cup elevator. This was put about 5 ft. under the natural ground level and extends between the two bins 40 ft. high, or about 10 ft. above the top of the bins. The dump is made with a screw feed at the bottom going into elevator and 2 x 6 cribbing on top to drive over with truck or wagon. A platform was built on top of the two bins and a rotary screen installed over the wall between the bins, so material of the different sizes could be spouted into one bin or the other bin and the oversize material spouted outside. The oversize material is resold to the dredging company at a price 40c a yard more than the price paid for the mixed material, so Mr. Trost feels he gets paid for handling the material through his machinery. On top of the bins a 7½ h. p. motor has been installed which drives the screw, elevator and screen from the top of the bins and there is a pent house over all of the machinery and belts. The rotary screen used is made up with the first ⅔ of the space having a $\frac{5}{16}$ in. wire mesh and the remainder with a ½-in. mesh.

In the fall of 1923, 6 staves were sent to Lewis Institute for test—both beam and absorption—and they gave an average of approximately 460 lbs. for the No. 102 stave and an absorption was about 5.2. Early in 1924 six staves were sent to the Patzig laboratory at Des Moines and they averaged close to 900 lbs., with an average absorption of 2.4 showing approximately 100% increase in quality. It had been a rule in the plant to make no more than eight staves from a sack of cement—staves 2½ x 10 x 30 in. This was adhered to strictly. Mr. Trost had gathered the information that he could make just as strong concrete as he was making prior to 1924 by proper grading of aggregate and using a mixture that would give 12 staves to a sack of cement. This was, Mr. Trost believed, out of the question as he did not want to take any chances and he felt well repaid if he could get double strength concrete and gain two more staves out of a sack of cement, and this was done with the staves sent to Des Moines for test.

A silo averages about 700 staves in Mr. Trost's territory and he built and made staves for about 100 silos in 1924. The extra equipment for handling coarser aggregate cost about $1,000, as Mr. Trost was fortunate in buying a second hand Caldwell elevator and screw that had been used in a silo plant which had discontinued business, and got a very reasonable figure on it. New equipment would cost probably about $1,500,—bins, labor, motor and elevator. Before 1924 Trost shipped about 3% extra staves to take care of staves damaged in transit. This required from 12 to 20 extra staves in each car or for each silo shipped. This always took care of all the breakage unless the car was in a wreck. In 1924 the extras were cut down to only about 1% and it has been plenty. This is another large saving on a 100-silo business in a year.

The net result then is a saving of 2% on breakage and a reduction of 20% on cement cost (10 staves instead of 8 to a sack). On the business of 100 silos a year that is a big item and he has increased the quality 100%.

Two Building Tile Plants in Pennsylvania


DUNTILE
Builds Better Buildings Cheaper
LEYDA CONCRETE PRODUCTS CO.
6TH & Railroad Sts. Monongahela, Pa.

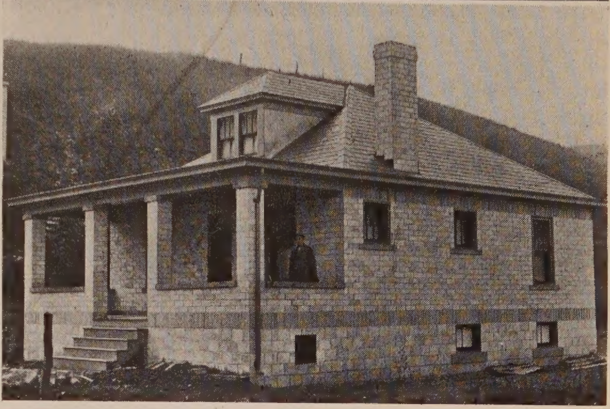


Fig. 1—A "billboard" built of concrete structural tile
Fig. 2—Monongahela cottage built of Duntile

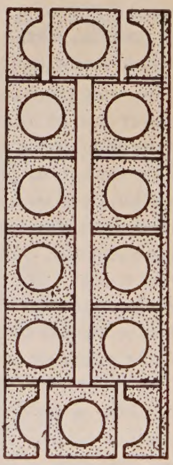


Fig. 3—One way to lay up Duntile to secure bond—using a split unit every fifth course. Another way commonly used is to employ metal ties between outside and inside courses. The various sizes permit a good deal of wall variation and bond when used for the entire job, or faced up with brick.

Two concrete products manufacturers in Pennsylvania have had rapid and interesting developments in getting their units into house and other construction—the Altoona Duntile Products Co. (Lind Brothers) at Altoona and the Leyda Concrete Products Co. (E. J. Leyda) at Monongahela. Both these plants are interesting because of the aggressive way in which they have gone about it to sell their communities and because the unit which they sell, Duntile, is radically different in its design and in the method of its manufacture from other concrete masonry units.

Duntile is different because it has a round, horizontal core like a drain tile within its rectangular exterior. This gives an unbroken surface not only on the two long faces but top and bottom. A vertical section of the tile shows what is sometimes criticized as an uneconomical distribution of concrete—that is, the core area might be larger, if of rectangular section, without cutting down the strength. As it is the strength of the unit is measured by the thinnest part of its wall. The arch in the "roof" of the tile is of value only when supported at both sides.

That is largely theory because test data are not available. In practice however other considerations sometimes govern. The ease and rapidity of manufacture, the ease of laying and the sales aggressiveness of the producer are important—especially as we have learned that strength is usually available to a greater extent than needed in light building construction.

When products manufacturers generally design their concrete mixes on the fineness modulus basis and everybody is achieving 100% in getting American Concrete Institute standard strength with the least cement, aggregate and labor cost, the niceties of design in the unit to obtain that strength will be of very much more consequence.

Duntile are made with the same kind of packerhead machines which have been used to form good drain tile. A rectangular hinged mold is set on the revolving table of the machine; the material flows in from the top through the core opening, a plate pressing down while the revolving packerhead comes up pressing and smoothing the inside toward the outside and discharging the surplus at the top—the units being made on end. The unit is removed from the machine in its mold or jacket; is set on end on a plank rack on a car; the jacket is removed—one of the dexterous movements the operator must learn—and the operation is repeated.

At Monongahela the Leyda plant was undergoing reconstruction. The machine hadn't run in two weeks. The crew are miners and two of them—machine operator and stripper—were plying their trade at timbering a frame building that threatened to fall down on the Leyda plant. Mr. Leyda made some statement about how many tile these men could turn out. Perhaps the writer looked incredulous. So the two men were called in—Hiram and William Gregg. William Harriston, who ordinarily runs the mixer was absent. The mixer, on an upper level is loaded by skip hoisted from below, the skip itself had to be loaded by wheelbarrow. While one man charged the skip the other adjusted the machine.

When the skip was loaded and started toward the mixer time was noted. A car stood along side. The loose planks of each deck were stood on end except for those on the first deck. The machine was started and the race was on—making 8-in. tile. The first one broke as the jacket was removed. A wrench was used to make a slight adjustment. No time was deducted however. When the first deck of tile was loaded the farther plank of the second deck was set in place and the stripper never missed a stroke as the tile came off. The two men worked like a piece of the machinery. When the first batch in the mixer ran low the machine operator wheeled the materials for another while the stripper operated the machine slowly, stopping to remove each tile. A car was filled—61 tile— and moved back onto a transfer and shoved into a curing tunnel while a new car was brought up; planks stood on end and operations begun. The second car had 62 tile—close spacing on the top deck. This number of tile is due to corner braces on the rack which reduce two rows from 8 to 7. Two cars of 8-in. tile, (123 tile—3 others broken) five batches mixed (four of them shoveled and wheeled) and one loaded car transferred and empty brought up—all in an even 40 minutes. Hiram and William Gregg say that's as fast as they can be made. That's a challenge. Ordinarily 1 man runs the mixer, 2 men operate the machine and 1 man works in the yard, keeping one curing room full and empty cars handy to the machine crew. The nominal output on 8-in. tile in 9 hours is 1460. The mix is 3 parts crushed stone with a good deal of fine material, 1 part sand and one part cement. The mixer and skip are all standard

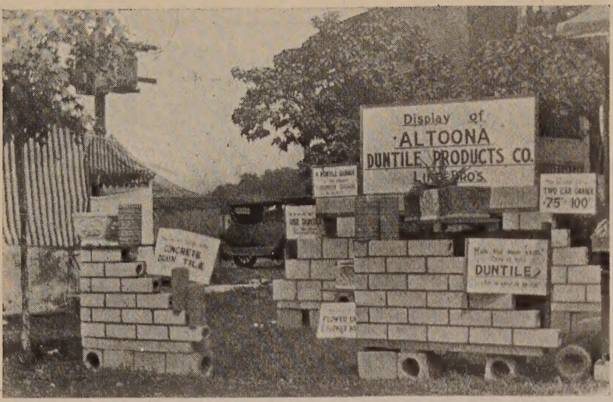


Fig. 4—An Altoona Products Co. display at a fair

Dunn equipment. The mixer is a pan, filled at the open top and discharged through a cone valve in the center of the bottom.

Leyda has been making Duntile about a year. He has succeeded in getting it into the foundation of an important down town building owned by a company which has a brick manufacturer on the board of directors. He did it by aggressive selling.

A few houses of Duntile are already in evidence in Monongahela. The 8-in. unit is too short (12-in.) for its height, but a 4-in. unit is attractive and permits interesting vertical courses, as in the cottage shown in the illustration. Near this cottage and on a high bank commanding an important road on a curve at the edge of town, Leyda has built a signboard—all of Duntile.

In Altoona, the Lind brothers' plant is one of the smallest and most inconvenient and altogether inadequate *looking* places, dignified as a products plant, the writer has ever seen and that is saying a good deal. This is no secret—Lind brothers know it and laugh about it.

This magazine has always warned the prospective manufacturer not to start until he had money enough—not alone for the machinery but to run the business for a while.

The exception proves the rule. The three Lind brothers were builders in a small way. In the spring of 1923 they looked into the products business, investigated the Dunn equipment and went home and talked Duntile. They didn't invest a cent until they had sold $40,000 worth of tile. Then they bought the machinery and had it rushed by express. While it was on the way they built "the plant" out of shiplap and tar paper on a lot owned by one of the three.

The machine came and was set up and they couldn't make tile. Mix wasn't right or machine not properly adjusted—tile fell to pieces. They had asked for no expert to start them. They had seen it done—it looked simple; but for a week the tile broke. They had booked $40,000 worth of business and couldn't make a tile. Then they did. The unit is made on end and stands on end to cure—no pallets. The mix has to be right to stand up. There is a knack in releasing the mold. A change of aggregate did the trick. The mix now is 4 parts crushed stone and sand—half and half—to one cement.

Five men operate the plant. One man loads the skip; 1 on mixer; 2 on machine, 1 on cars. This is not economical operation to get 100 8-in. tile per hour, or 150 6-in. or 200 4-in.

Yet this uneconomical, inconvenient plant has never caught up with orders and for $1,000 invested in April 1923 the Lind brothers say they wouldn't sell out for $30,000.

The plant began early to run 2 shifts and in the last summer ran 3 shifts. From April through November 1924, the output was 235,000 tile.

A new $15,000 plant (built out of profits) for two machines and a trim stone department has been built on a desirable railroad site and a move was to be made as soon as zero weather should stop the demand.

In the new plant 1 extra man (6 in all) will double the output. One man operating mixer from below so he will load his own skip; 2 men on each machine, 1 man on cars.

Faced Duntile are made with special Dunn compressed air equipment which blows on a mix of cement, color and water, and integral waterproofing, with very fine aggregate if desired. One man can face the output of one machine.

National Concrete Products Association

The National Concrete Products Association held a convention in Milwaukee January 28, 29 and 30—the first one in several years—a very successful meeting, one that promises to weld the better elements in the business into a tool that will aid in spreading the knowledge the progressive ones have already gained as to economical production, sound business policies and more general adherence to the standards of the American Concrete Institute.

The best meeting of the convention, which came too late in the month to be considered in any detail in this issue of CONCRETE, was one which listened to discussions by E. W. Dienhart, J. W. Lowell and others of the application to actual plant practice of the fineness modulus principle of proportioning. From a more or less hazy conception of something that looked like laboratory "fancy work," many products makers are seeing a dollars and cents meaning in scientific combination of materials, coarser materials, more water, better curing. These things have had actual demonstration. They aren't theory any more but practice. When a man in Illinois who is getting 16 blocks from a bag of cement finds that a neighbor producer with similar but differently combined materials is getting 22 blocks from the same quantity of cement and *a better block* in the bargain he can't rest until he learns how to do it. Mr. Lowell, who is chairman of the Institute's Committee P-6 on Products Plant Operation, announced that all this will be explained and demonstrated at one of the products sessions of the American Concrete Institute convention in Chicago, Feb. 24 to 27.

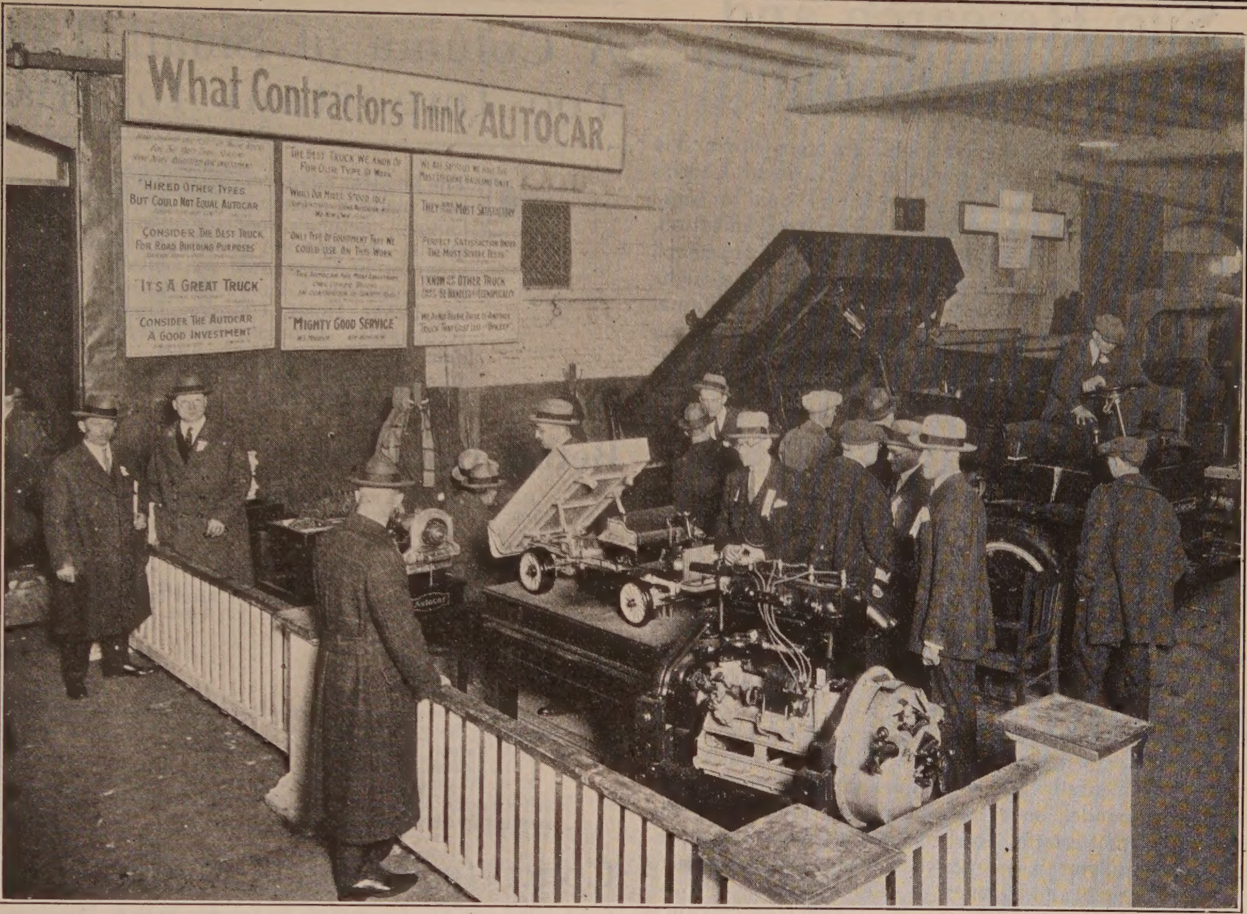
There were also very worth while discussions of advertising and promotional efforts.

A new set of officers was elected headed by W. H. Carey, president. Mr. Carey, a successful manufacturer in Wisconsin Rapids, has been a leader in the Wisconsin organization—in fact the progressive work in Wisconsin, along with that of Illinois and Ohio, is largely responsible for the reorganized National association.

Other officers and directors elected are: First vice president, S. I. Crew, Cincinnati, O.; second vice president, C. E. Lindsley, Irvington, New Jersey; treasurer, Jacob Bosch, Chicago, Ill.; Directors: W. R. Harris, Chicago, Ill.; J. A. Livingston, Toronto, Ont.; E. W. Dienhart, Cement City, Mich.; Geo. Barriball, Cleveland, Ohio; Geo. Saffert, New Ulm, Minnesota; John Powers, president Illinois Association; Austin Crabbs, Davenport, Iowa; C. O. Gochnauer, Appleton, Wisconsin; A. V. Johnson, Nebraska; Newton D. Benson, Providence, Rhode Island; W. H. Brooks, Birmingham, Ala.

W. R. Harris, retiring president, was given a vote of thanks and a well filled purse.

If you have a good idea, pass it on—tell the other fellow, as Mr. Trost has on page 74.


What Contractors Think AUTOCAR
"HIRED OTHER TYPES BUT COULD NOT EQUAL AUTOCAR"
CONSIDER THE BEST TRUCK FOR ROAD BUILDING PURPOSES
"IT'S A GREAT TRUCK"
CONSIDER THE AUTOCAR A GOOD INVESTMENT
THE BEST TRUCK WE KNOW OF FOR OUR TYPE OF WORK
"MIGHTY GOOD SERVICE"
THEY ARE MOST SATISFACTORY
I KNOW OF NO OTHER TRUCK
Autocar

Autocar Exhibit at the Chicago Good Roads Show

What Contractors Say About Autocar Trucks

"Have operated our fleet of twelve Autocars for the past three seasons; have never regretted our investment." JANSEN & SCHAEFER, Pekin, Ill.

"The best truck we know of for our type of work." DAVID SCHOENTAG, INC., Saugerties, N. Y.

"We are satisfied we have the most efficient hauling unit."
P. J. TROMPETER & SONS, Peru, Ill.

"Hired other types, but could not equal Autocars."
CORRADO & CALIARDI CONST. CO., Connellsville, Pa.

"While our mixer stood idle sub-contractor using Autocars worked; we now own eight."
CONNELL, LAUB & BRACHT, Dayton, Ohio.

"Consider the best truck for roadbuilding purposes."
JOHNSON, DRAKE & PIPER, Minneapolis and Pittsburgh.

"Perfect satisfaction under the most severe tests."
McCLURE & BINGNER CO., INC., Jonhstown, Pa.

"They are the most satisfactory."
D. L. DENNIS, Bradford, Pa.

"Only type of equipment that we could use on this work."
COMERFORD CONSTRUCTION CO., INC., Philadelphia, Pa.

"The Autocars have many advantages over other trucks in construction of concrete roads."
LOUIS MAYERSOHN, Albany, N. Y.

"It's a great truck."
COLONIAL CONSTRUCTION CO., Pittsburgh, Pa.

"Consider the Autocar a good investment."
D. W. CHALLIS & SONS, INC., Sewickley, Pa.

"We do not believe there is another truck that costs less for upkeep."
VERHEY CONSTRUCTION CO., Champaign, Ill.

"I know of no other truck that could be handled as economically."
EMIL RASMUSSEN, Cedar Rapids, Iowa.

"Mighty good service."
W. S. MORRISON, New Brighton, Pa.

"After using practically every make of truck on the market, we are standardizing on Autocars for our highway work, using them both for grading operations and batch hauling."
W. C. Guncheon & Company, Harrisburg, Pa.

"I've had experience with a good many different makes of trucks on road building, but there is nothing that can come anywhere near touching an Autocar."
C. T. Davis, Atlantic City, N. J.

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Silo Research and Promotion

At a joint session of the National Concrete Stave Silo Association and the Silo Department of the National Association of Farm Equipment Manufacturers it was voted to merge their interests in one comprehensive national organization, to be called the National Silo Research Institute. It seemed quite evident that members were inspired by the thought that no matter of what material they built their individual silos, their industrial welfare was bound up in the extension and wider acceptance of the silo *idea.* Noble T. Praigg, Praigg, Kiser & Co., 222 E. Ontario St., Chicago, who will be active in directing the new work made a detailed statement of exact dollars and cents percentages of industrial gain which had been recorded by about twenty national industries—after they reconciled their interests and decided to compete individually but cooperate collectively. The plan of the new Institute will be as nearly scientific as a commercial program can be made. It will start from the inside and work out, rather than seek to go into the highways and byways and build immediate silo sales. Information will be assembled from every possible source relating to silo use, silo experience, silo good points—and bad—with a view to developing high industrial standards.

The Institute will exert every effort to develop a closer sympathy among manufacturers of different silo types, because fundamentally the salvation and the future of the industry are founded on a more hospitable attitude on the part of the farmer relating to the silo *idea.* Then the representative manufacturers will get their share in proportion to their aggressiveness and alertness of sales activity

American Concrete Pipe Association

The American Concrete Pipe Association concluded a very successful meeting in Chicago early in January with representatives from more than 25 manufacturers in the United States and Canada present. The outstanding accomplishment of the meeting was the decision to take measures to maintain a high standard of quality throughout the industry. In fulfilment of this work, M. W. Loving who was re-elected secretary, was authorized to inspect plants and otherwise assist all manufacturers, non-members as well as members, with their problems.

The officers of the association chosen for 1925 are: president, G. H. Redding, Massey Concrete Products Corp., Chicago; vice president, E. F. Bent, Bent Concrete Pipe Co., Los Angeles, Calif.; W. K. Cain, Minnesota Pipe and Tile Co., Mankato, Minn.; A. M. Hirsch, Lock Joint Pipe Co., Ampere, N. J.; secretary, M. W. Loving, 111 W. Washington St., Chicago.; treasurer, G. E. Warren, Chicago.

Van Guilder Double Wall Construction

Van Guilder double wall machines, used in a system of construction many times the subject of articles in CONCRETE, are now sold outright rather than on territorial or royalty basis. This development follows a complete reorganization in which the Van Guilder system of concrete wall construction has been acquired by the Van Guilder System Concrete Building, Inc., 15 East 40th St., New York City. George Hopper of Isaac Hopper's Sons, contractors, is president of the new company; M. Charles Schweinert is chairman of the board and Richard Dobkin, treasurer.

A Column of Small Type Too Important to Miss!

¶ The greatest advances that have ever been made in a knowledge of field and factory methods for controlling the quality of concrete will feature the program of the annual convention of the American Concrete Institute at the Drake Hotel, Chicago, Tuesday, Wednesday, Thursday and Friday, Feb. 24, 25, 26 and 27, 1925. Here are some of the subjects and the men who will discuss them:

Better Concrete

How the railroads are putting quality control theories into practice—four important papers of interest to every man who has **anything** to do with **any** phase of concrete work of **any** kind—four papers discussing definite jobs, by

C. P. Richardson, Engr. Track Elevation, C., R. I. & P. Ry.
T. P. Watson, Asst. Engr., Pennsylvania R. R.
A. W. Munsell, Asst. Engr., Delaware River Bridge Joint Comm.
R. M. Miller, formerly Res. Engr., Va. Term. Ry.

Form Work

A symposium on forms—for columns and floors, and adjustable shores vs. 4x4's—eloquent experience fresh from the job by

J. A. Turner, Turner Const. Co., Philadelphia
L. H. Usilton, Barney Ahlers Const. Corp., New York
E. C. Harding, Ferro-Concrete Const. Co., Cincinnati

and a meaty, intimate round-table discussion of job problems—bring your pet problem along.

Concrete Products Manufacture

Three sessions are especially for Concrete Products Manufacturers, two of them constituting a school on economical concrete products plant operation. Demonstration with sieves and aggregate samples of the application of the fineness modulus method of determining economical aggregate proportions in the manufacture of building units. Products manufacturers will be shown a method which will eliminate thousands of dollars waste in the practice of arbitrary mixture, give more block per sack of cement and at the same time obtain greater density, lower absorption and higher strength.

Post Mortem

The committee on Destructive Agents and Protective Treatments will consider the report of the field survey of concrete which is failing, or has failed, under exposure, as compared with concrete under similar conditions which shows no signs of disintegration. The underlying causes and remedies will be presented.

and then—

Five more highlights: 1—Thaddeus Merriman's paper on the responsibility of cement for the shortcomings of concrete; 2—Maximilian Toch's paper on color, waterproofings and other things to mix with concrete; 3—G. W. Hutchinson's discussion of proportioning concrete for highway work; 4—Dr. W. K. Hatt's report of how men on the job were educated in quality control on concrete on the Purdue Stadium job; 5—Dr. P. H. Bates, U. S. Bureau of Standards, on "Crazing."

And still further—

Road and pavement specifications.
Floor finish methods.
Stucco and other surface treatments.
Concrete bins for cement storage.
Building regulations affecting reinforced concrete.
Sidewalk and floor specifications.
Concrete pipe standards.
Measuring and estimating concrete.
Expansion joints.
Fire resistance of concrete.
Concrete houses.
Design of concrete chimneys.
Central mixing plants.

Everybody Welcome—We Expect YOU!

Every reader of this magazine is invited—you ought to be a member but if you're not, come anyway. When you buy your ticket, ask for a certificate—you may get back home at a lower fare that way. For complete convention details, including reduced fare plan, write

AMERICAN CONCRETE INSTITUTE
1807 East Grand Boulevard, Detroit, Mich.